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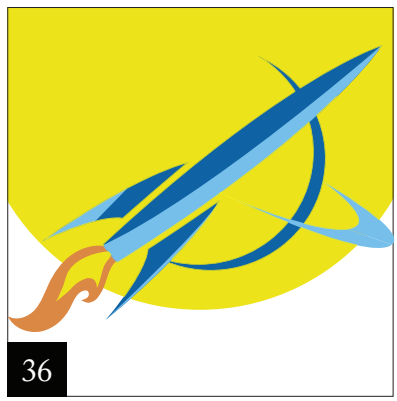

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[FROM THE EDITOR

Celebrating Our Skeptical Guides

What would *The Skeptics' Guide to the Universe* (*SGU*) podcast look like as a magazine? As a fan of the podcast (who happens to edit a magazine), I posed that exact question to the *SGU* team. The *SGU* was the first podcast I discovered and the one I have listened to the most. Lucky for us, they all wanted to find out too.

The idea began when I realized they were recording their 1,000th episode live in Chicago, a mere four-hour drive from my house. I snatched up a ticket and asked their long-time collaborator, George Hrab, if he'd write a commemorative article for Skeptical Inquirer. To my delight, he ended up reading it to the live audience.

The *SGU* also recently reached another big milestone—twenty years. The first episode aired in May 2005. To celebrate these milestones, each of the cohosts wrote a piece for SI, and as an introduction Steve Novella asks, "After Decades of Skepticism, How Are We Doing?" His must-read answer sets the stage for all the articles to follow.

Just like in the podcast, each cohost takes the lead on one topic, adapting for us their coverage of the dubious claims from the 1,000th episode: Evan Bernstein examines UFO reporting, Cara Santa Maria explores medical scams, Robert (Bob) Novella looks back at cold fusion, and Steve Novella provides a brief history of climate denialism. Also, as he did during the live show, Jay Novella offers a heartfelt tribute to his brother, Steve, the *SGU*'s leader.

But wait, there's more! Every episode of the *SGU* includes games, such as "Who's That Noisy" and "Science or Fiction," and these games made their way into our very own Fun & Games section too. Each episode also closes with a skeptical quote, and we include a feature article from Guy P. Harrison highlighting the most notable quotes from science fiction. I'd also like to add one quote from science fiction writer Greg Bear: "I believe that science fiction writing, at its finest, is an enormous leap of skeptical imagination" (SI, September/October 1996).

Many thanks to the *SGU* team for being our skeptical guides. Three of my other favorite podcasts include *Point of Inquiry* (hosted by Jim Underdown), *Squaring the Strange* (cohosted by Ben Radford and Celestia Ward), and, of course, *Skeptical Inquirer Audio Edition* (created by Eric Shaver).

—Stephen Hupp

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News Bites: From Chatbot Therapists to the Scopes Monkey Trial Centennial

Stephen Hupp

FTC Urged to Act on Bot Therapists. On December 20, 2024, on behalf of the American Psychological Association (APA), Arthur C. Evans, PhD, wrote to the Federal Trade Commission (FTC): "We have grave concerns about 'entertainment' chatbots that purport to serve as companions or therapists, especially because some of these technologies are available to the public without appropriate safeguards, adequate transparency, or the warning and reporting mechanisms necessary to ensure appropriate use and access by appropriate users. Incidents are increasingly coming to light where someone struggling with mental health issues, often an impressionable adolescent, has experienced negative impacts from interactions with a publicly available AI-driven chatbot due to a lack of appropriate safeguards."To date, the FTC has not yet responded to the APA's request. (For more, read "Using Generic AI Chatbots for Mental Health Support: A Dangerous Trend" at apaservices.org.)

Woman Pleads Guilty to Graceland Fraud. On February 25, 2025, a woman pled guilty to mail fraud for scheming to sell Graceland without the proper authority. Allegedly, the woman used a fake company, false court filings, and a forgery of Lisa Marie Presley's signature to attempt to pull off the scheme. (For more, read "Woman Pleads Guilty to Scheme to Defraud Elvis Presley's Family" at justice.gov.)

Pokémon-Shaped Cheeto Sells at Auction. On March 2, 2025, a Flamin' Hot Cheeto shaped like the Pokémon character Charizard sold at auction for a lot of cheese. With help from pareidolia (the tendency to perceive meaningful patterns within vague stimuli), this "Cheetozard" sold for $87,840, just under the price fetched by a previously discovered Cheeto shaped like a lovable

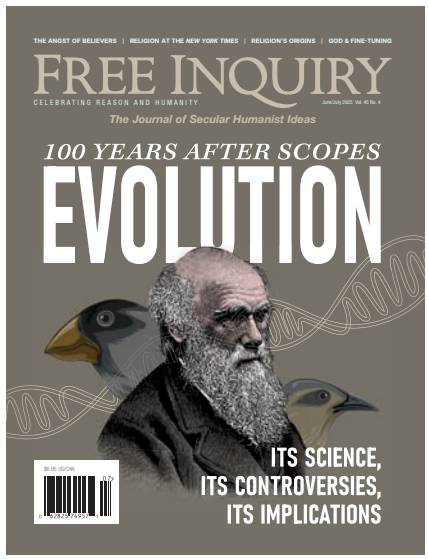
gorilla named Harambe ($99,900). (For more, read "A Cheeto Shaped Like the Beloved Pokémon Charizard Is Auctioned for $87,840" at apnews.com.)

Best Opening Chess Move Revealed. On April 1, 2025, a study using artificial intelligence revealed that pawn-to-king's-rook-4 is the best opening chess move. Well, actually … the year was 1975 (exactly fifty years ago this April) and the new "discovery"—AI and all—was mentioned in Martin Gardner's Mathematical Games column in *Scientific American*. Gardner's reporting on this winning move is now included on Wikipedia's page for the "List of April Fools' Day Jokes." (For more, read "Six Sensational Discoveries That Somehow or Another Have Escaped Public Attention" at scientificamerican.com.)

The Dire Wolf Is Back, Kind of. On April 7, 2025, a private company reported on their attempt to bring back dire wolves from extinction. Delighting *Game of Thrones* fans everywhere, the company now has three fluffy white wolf pups—Kaleesi, Romulus, and Remus—made possible from the extraction of DNA from a 13,000-year-old tooth from an actual dire wolf. The company used genetic engineering to modify the modern-day gray wolf (which is already a 99.5 percent DNA match with extinct dire wolves). Some news coverage implies these wolf pups actually are dire wolves; however, they are more like gray wolves that have been engineered to *look* like the larger dire wolves. One day, the company hopes to apply this same technology to the woolly mammoth. (For more, read "De-Extincting the Dire Wolf" at theness.com.)

Attend the Scopes Trial Centennial Conference. July 10, 2025, represents the one hundredth anniversary of the beginning of the Scopes Monkey Trial in which John T. Scopes was found guilty of teaching human evolution in a state-funded high school (the verdict was later overturned due to a technicality). This landmark case serves as the cover story for the latest issue of *Free Inquiry* magazine, and the Center for Inquiry will commemorate the trial in an event held from July 18–20 in Chattanooga, Tennessee. (For more, see the back cover of this issue of Skeptical Inquirer.) ■

Stephen Hupp is the editor of Skeptical Inquirer.



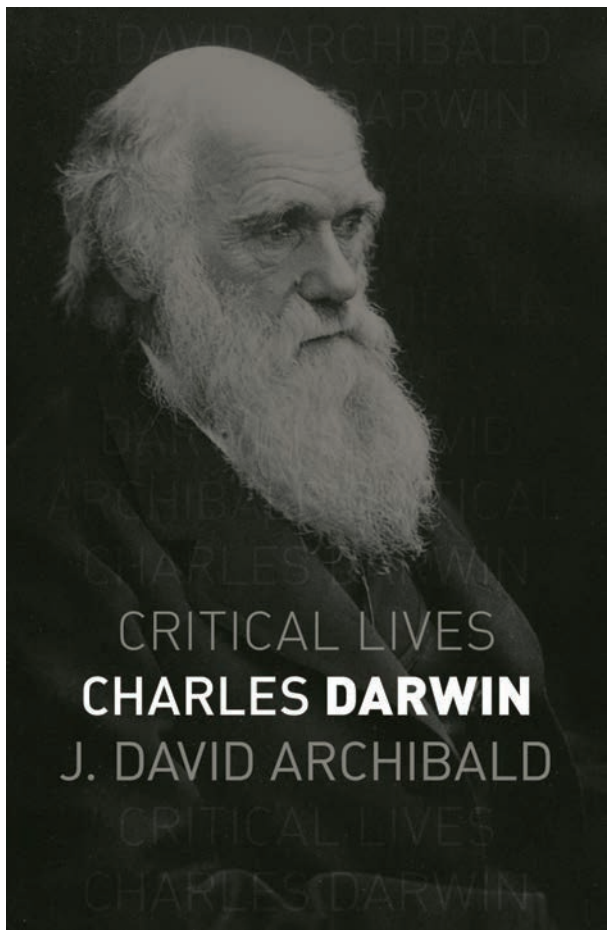
COMMENTARY]

Misrepresentation of Charles Darwin on Eugenics and Social Darwinism

J. DAVID ARCHIBALD

Moreso than almost any other person who influenced the course of human history, Charles Robert Darwin has been both revered and reviled. In the latter category are the darker legacies of the related concepts of social Darwinism and eugenics. These pseudosciences have been laid at Darwin's doorstep by those who either do not know his theories or twist them to their own use. Both these concepts are traceable to the regrettable phrase "survival of the fittest," proposed by political theorist and philosopher Herbert Spencer. Spencer first used the phrase in 1864 in his *Principles of Biology* after reading *On the Origin of Species*. He tried to draw similarities between his economic theories and the biological theories proposed by Darwin. Under the urging of Alfred Russel Wallace, the co-discoverer of natural selection, Darwin unfortunately came to use the phrase as synonymous with his "natural selection." Darwin did not abandon his natural selection but did oblige Wallace by using Spencer's phrase in the 1869 fifth edition of *On the Origin of Species*. Over the years, this has proved an unfortunate alternative, because trying to define Spencer's meaning of *fit* leads to a tautology: Who are the survivors? The *fit* are those that survive. Thus, the phrase becomes "survival of the survivors."

Survival of the fittest became closely associated with the theory of social structure misleadingly titled *social Darwinism*. In *The Descent of Man*, Darwin discussed natural selection as it applied to humans of his Victorian milieu—with the unquestioned acceptance of the Western world as the pinnacle of civilization, the belief strikes us today at best as paternalistic and at worst racist. In this, Darwin was much like his contemporaries, except that he saw natural selection continuing to affect humans in both "savage" and civilized societies but not the societies themselves *per se*. This was unlike some, such as Wallace, who argued that the effects of natural selection diminished as conscious modern civilized man emerged. English essayist William Rathbone Greg agreed with Wallace but argued that all the niceties of civilization, notably medicine and relief for the poor, dampened natural selection's effect on society. Herbert Spencer took it to the obvious conclusion by promoting a laissez-faire approach with no governmental regulation of private businesses and natural selection winnowing out weak elements of society. Darwin muddied the waters by at times seemingly supporting these men's view that supposedly more respectable members of society needed to produce more offspring.

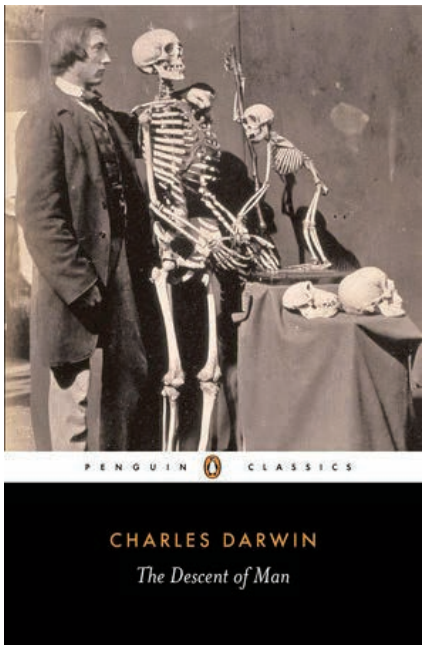


No single, coherent explanation exists to explain the pseudoscience of social Darwinism. One of its better-known iterations argues that the wealth and power of the strong will increase while that of the weak will decrease—laissez-faire capitalism—hence reference to Spencer's survival of the fittest. The concept has also incongruously been applied by supporters of governmental socialism and colonization. Whether such societal and economic trends exist in any of these guises is irrelevant, because social Darwinism erroneously equates them to the natural world in which variations in organisms

are winnowed by natural selection and passed through inheritance to succeeding generations. No such processes operate within human society. Thus, there is a clear disconnect between Darwin's theory of natural selection and social Darwinism, a concept to which Darwin never subscribed but did lean toward.

Survival of the fittest also plays a clear role in the misguided belief that the human species improves by not allowing people deemed inferior to breed, a clear extension of at least one form of social Darwinism. Darwin never advocated such a stratagem, although he certainly suggested that the better-off in society should have more children. He believed that all humans form a single species arising from a common ancestor—the theory of monogenism—whom he theorized in *The Descent of Man* came from Africa. In the nineteenth century, monogenism was strenuously opposed by polygenism, which argued that human races derive from separate origins (sometimes called different species). The latter view contributed to the subjugation of people deemed inferior. Even though monogenists, including Darwin, argued that humans had a single origin, it did not mean they were much less prejudiced toward those who belonged to what were deemed to be lesser races or who came from what were seen as inferior countries. Many Victorians held that their social system was superior to most others and was more likely to triumph in the end. Darwin was raised to believe that slavery was abhorrent but at the same time shared the common Victorian view that some peoples of the world, such as the Fuegians he met in South America, were primitive savages and a lower grade of human. Although in general accepting this view, Darwin, in the *Voyage of the HMS Beagle* also argued that the poorer state of some human beings resulted from unjust social institutions, not simply perceived ideas of a more primitive evolutionary grade of human.

Several threads leading to the origin of eugenics mistakenly tie Darwin to the views of his half-cousin Francis Galton, one of its founders and the man who



coined the word *eugenics* in 1883, the year after Darwin died. The two shared a grandfather, Erasmus, but not a grandmother. An English statistician, Galton read Darwin's work, making the erroneous leap that Darwin's findings could be used to improve the human race—a point with which Darwin disagreed. Some continue to try to read into Darwin's works statements supporting eugenics. These attempts are always out of context. In fact, what Darwin argued is that humans, like all other species, are subject to natural selection, a view we know today is true but well ahead of its time in the nineteenth century.

The only real connection of Charles Darwin to eugenics was through his eighth child, Leonard, who took over the helm of the British Eugenics Society in 1911 from its founder Francis Galton, serving in this capacity until 1928. Leonard encouraged the society's members, in an article published in 1916 titled "Quality Not Quantity," to have more children, but as the movement grew more strident, so did its goals. In the earlier part of the twentieth century during Leonard Darwin's tenure as president of the society, eugenics found a place in academia. Eugenics societies sprung up in various countries, and international conferences were held. The movement did not remain merely academic following the passage of sterilization laws. One of the earliest and most aggressive adopters was the United States, which forcibly or without consent sterilized more than 64,000 individuals between 1907 and 1963 (Lombardo 2008). Nazi Germany took notice in the 1930s of programs in the United States and soon began their own. Obviously, the Nazi practice of enforced sterilizations of those they deemed inferior was far more insidious and barbaric and went far beyond the schemes of other nations. It would be one thing if distortions of Darwin's work had faded over time, but this is not simply a historical exercise. As recently as 2017, a supposedly reputable biography presented Adolf Hitler's anti-Semitic rhetoric as if it could have been written by Darwin (Wilson 2017). The harm is the pretense of it being true, but, as one reviewer noted, it is simply "Darwin bashing" (Moulin 2017).

In the final analysis, Charles Robert Darwin was quite broad-minded, with a liberal upbringing that shaped his character and political views, including molding his revulsion to slavery. In another sense, he was very much a Victorian man hewing to the conventions of the time and society. Yet it remains an erroneous endeavor to paint him as a supporter of eugenics and social Darwinism, two misguided and ultimately dangerous ideas that took hold only after his death. ■

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J. David Archibald, PhD, is a paleontologist and historian of biology. He served on the faculty of Yale University and is professor emeritus of biology at San Diego State University. He is the author or coeditor of many books and articles, including *Charles Darwin* (Critical Lives series) from which this commentary is adapted.

COMMENTARY]

Viral Flu Bomb: False Health Claims from an Australian Influencer

KEN MCLEOD

The *New York Post*, one of America's most popular and oldest tabloid newspapers, recently promoted false claims from Barbara O'Neill regarding one of her alternative medicine potions. Published January 2, 2025, Carly Stern's article is titled "What's a 'Flu Bomb'? The 7-Ingredient Recipe Fans Say 'Eradicates' Illness."

Stern's article goes into hyperbole, such as "This is your natural antibiotic," describing how this "antibiotic" cures bronchitis, sinus infections, or pneumonia and how "they take the flu bomb." Stern quotes O'Neill's "flu bomb" ingredients as "eucalyptus oil, garlic, ginger, honey, lemon, cayenne pepper, and water."

So, after bypassing O'Neill's clearly false claim that an antibiotic can cure a viral illness, Stern then failed to do the most basic of fact-checking that would be appropriate if, as is true in this case, the article were directly lifted from a TikTok video—hardly the most reliable of sources.

A little bit of searching would have brought up O'Neill's Wikipedia page, revealing that in her native Australia, she is a widely known promoter of ineffective medical practices, has no medical qualifications, and has been banned from engaging in any health activity in Australia. Then there's hundreds of other articles exposing O'Neill. For example, there's one at *Science-Based Medicine* (Hall 2019) and one in Australia's *The Skeptic* magazine about how she advocates putting asbestos in vaginas (Mendham and McLeod 2022). The Cook Islands have even banned O'Neill.

That is one mystery: Why did Stern so gushingly report such rubbish? The next mystery is: What were the *Post*'s editors doing? Was this just laziness and incompetence? Editing a tabloid newspaper is no excuse. Such questions should be put to the *Post*'s editors by the U.S. skeptical community.

Skeptics in Australia have waged campaigns for many years against quackery and sloppy reporting in the media and against promoters of false health claims, particularly those making anti-vaccination claims. We have had many successes in turning public attitudes around, particularly in the media ("False Balance Leads to Confusion" 2012) and politics (Australian Greens 2013). We have succeeded in having legislation changed to shut out those promoting anti-vax claims ("Changes to HCCC Act" n.d.), including those by O'Neill, and persuaded regulators to enforce legislation, such as when O'Neill's charity license was canceled ("ACNC Revokes Charity Registration" 2021).

However, O'Neill is not going away and will continue her campaign against evidence-based medicine all over the world, excluding Australia but including the United States. She uses the extensive Seventh-Day Adventist (SDA) network, but not all SDAs agree with her (Seibold 2024), to their credit. The SDA's top governing body for the SDA worldwide has issued a statement: "We are not able to recommend her as a speaker for churches or any gatherings" (NewsHound 2025).

Skeptics everywhere should be encouraged to expose O'Neill's false claims as the danger to public health they are—to the *Post*'s editors, the media generally, politicians, and regulators. It's in everyone's interest. ■

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Ken McLeod is a retired air traffic controller and Australian national manager of search and rescue. Those positions exposed him to the worlds of conspiracy theorists, psychics, and grief vampires. Retirement gave him the time to campaign against them with the aid of the Australian Skeptics, who awarded him with Honorary Life Membership and the Thornett Award for the Promotion of Reason.

Pseudo-Etymology: Do Words Have Hidden Meanings?

TALIA FELIX

Running an etymology dictionary isn't as straightforward as it might seem (e.g., people often mistake *etymology* for *entomology*). During a dinner conversation, when I mentioned my work at the Online Etymology Dictionary, someone started talking about insects, mistaking *etymology* for *entomology*. This kind of mix-up is common; many people are unfamiliar with the term and its meaning.

Yet there is a more pernicious misconception about etymology that concerns its original meaning: "true (meaning) study." Serious linguists have long abandoned the notion that words have some innate "real meaning" that etymology seeks to uncover. This archaic view assumes a "word decider" endowed humanity with a fully formed language and that studying the words to determine their hidden "truth" will bring the seeker important and perhaps even mystical knowledge. Modern linguistics recognizes language as a human creation, constantly evolving. Old English (*"Đætte unlærede ne dyrren underfon lareowdom"*) is markedly different from Modern English (*"That the uneducated not deign to undertake teaching"*) because words and their meanings will change over time.

Consider the word *gaslight*. A century ago, it referred to a light fueled by gas. After the 1944 movie *Gaslight*, in which a woman is tricked into doubting her sanity, the term gained a new meaning: "to deliberately make a person believe that they are insane" (from etymonline.com). The components of the word—*gas* and *light*—don't contribute to this modern meaning. Studying the roots of *gas* and *light* won't reveal any special truths about this sense.

Yet many people cling to the outdated belief that etymology reveals the "true meaning of words." And through this view, we find ourselves overlapping with the realm of occultism and conspiracy theories.

Some practitioners use etymology to find "true meanings" in words, which are then used to reveal truths about the world at large. This version of etymology, which strives to find the hidden meanings that are somehow obscured from being recognized and yet remain innate in the words, continues a long tradition of pseudolinguistics by people who use it to promote their personal beliefs.

Promoters of this type of etymology claim that words are "literal spells" casting magical influences upon people via their secret meanings. This alleged system, in which *sounds like* = *from*, suggests easy-to-understand etymologies that purport to confirm secret truths about the world. For instance, this method shows that the word *week* is so called because you go to work during the week and it makes you *weak*. No consideration is given to details such as what a pre-industrial revolution worker's schedule was like when the word first appeared in English; in fact, there's no recognition at all that the world or the language differed significantly from what we know today. They claim that weeks just exist to weaken you with work, and they were named so as to conceal and yet to also remind you. (The genuine etymology of the word *week* is that it comes from Old English "wucu," meaning a turning or succession of time. *Weak* is unrelated, from Old Norse *veikr*, "weak.")

Conspiracy theories thrive on this kind of "decoding" of "secret messages," which are sinister and negative. It's rarely found that anyone uncovers *positive* secret messages. Planting beliefs that everyone is out to get you by maliciously greeting you with "Hello" (*hell* + *low* meaning they want you to descend to Hell) stirs instant fear, ensuring that no one thinks too hard about the claim and instead goes into immediate panic mode. The dangers are not to be overlooked; actual violence has been provoked by believers in such conspiracies, who are stirred to act by a will to fight against the concealment of such "truths."

The reality is there are no hidden meanings in words. Words are not stable facts; instead, they change with context and language. If a *week* is really so called because it makes you weak, how can this operate for another language such as French where these words (*semaine* and *faible*, respectively) do not sound similar?

If uncovering truths from words were possible, they surely wouldn't present themselves as other modern words, which themselves can be reinterpreted. If there were innate truths in the language, shouldn't these truths present as meanings that would be universally understood and not subject to language differences or reinterpretation?

The appeal of pseudo-etymology lies in its illusion of control over reality, in the way that it allows one to "confirm" the beliefs one has always held with pretense of facts. However, promoting lies and instilling fear is harmful. Genuine etymology can be a defense against such dangers. Understanding real word histories protects against manipulation by those seeking to control with panic-provoking lies or pretensions of offering mystical insight.

So, while basic etymology might seem nerdy or impractical, it is a worthwhile pursuit. It grounds us in reality and shields us from the harm of pseudolinguistics. ■

Talia Felix is the assistant editor of the Online Etymology Dictionary.

Remembering Joe Nickell (1944–2025)

Credit: Susan Gerbic

Joe Nickell—The Master Solver of Major Popular Mysteries, The Detective of the Impossible, The Modern Sherlock Holmes—enjoyed many epithets during his life, including these three titles bestowed by Kendrick Frazier, Massimo Polidoro, and Paul Kurtz, respectively. My favorite for Joe, though, will always be "Skeptical Inquirer Columnist" because through this magazine his writing affected my life on a bimonthly basis, first as a reader and then as an apprehensive editor, tasked with "editing" the writing of Skepticism's Most Prolific Author. Not only did Joe regularly bring the joy of curiosity into my life, but he also inspired so many other skeptical titans, amplifying that joy beyond measure. I wrote a tribute to Joe in the previous issue of SI, so now it's time to read tributes from many of his other greatest admirers.

—Stephen Hupp

Timothy Binga

The news of the passing of our colleague Joe Nickell quickly spread through the offices of the Center for Inquiry. Since he had "semi-retired," he still came into the offices occasionally, and it was not an unfamiliar sight to see him going to various offices to speak to staff members and catch up with friends.

Joe was a CSI institution. He started working for (what was then) CSICOP in 1995, hand-selected by Barry Karr and Paul Kurtz to be an on-staff investigator of various claims, rather than a fellow or consultant who may or may not be available at any given time. As a result, two things: He became the world's first paid full-time paranormal investigator, and he became a spokesperson and the face of the organization. If there was a media query, certain topics would be forwarded to other CSICOP fellows—UFOs to Phil Klass, parapsychology to Ray Hyman, and so on—but Joe would be the contact for anything general or specific to his research. There have been hundreds of visits to the Center for Inquiry from the media over the years, and Joe was in most of the resulting video, film, interviews, etc.

Some of the more prominent appearances Joe made over the years include the CSI television series *The Critical Eye*, Bill Maher's *Politically Incorrect* (with supporter Steve Allen), *Strange Explained* (pilot for a TV show based on Joe's investigations), and *The Science of Magic* documentary (Harry Anderson was the host; Joe performed the Gypsy Egg trick on me). The role of the investigator played by Hilary Swank in the 2007 film *The Reaping* was loosely based on Joe, and he appears in the extras on the DVD of the film. He also made appearances on various paranormal TV shows—*The Lost Tapes*, *In Search of*, *Unsolved Mysteries*—as well as various cable shows such as *Mysteries at the Museum*.

As librarian for CFI, I had the re-

sources Joe needed for his research, and eventually this evolved into my role as Joe's "handler" as it was called. I conducted a lot of research for Joe, initially in books and periodicals we had here but eventually online searches and such. He began to call me "The Masked Librarian" because I was able to find a lot of hidden information for him. As Joe was not confident with email, I began finding myself doing more and more email correspondence for him, which led me to the "handler" role.

I also traveled with Joe to various places, including DragonCon in Atlanta (I was present for a memorable dinner with Joe and James Randi there), and we traveled to conduct research. One particularly memorable experience was driving to Hydesville, New York, to examine the foundations of the Fox Sisters' cottage. I thought I was there just to drive, but when we went to the local library, Joe stated to the staff: "This research is so important I brought my own librarian!"

Though Joe was a prominent skeptic and most know him for his writings on the paranormal, he was also a world-renowned forensic documents expert. His PhD was in English, and he focused on folklore and literary investigation. This evolved into forensic investigations due to his interest in authenticating. His first forensic book, *Pen, Ink, and Evidence*, became the definitive work on writing instruments. He created a personal collection of pens, quills, inkwells, eraser knives, etc., that was donated to (and is now located in) the University of Kentucky. He wrote other forensic works as well and authenticated several things over the years.

He proved that the "Night Before Christmas" was actually written by Clement Moore; he worked on Henry Gates Jr.'s *The Bondwoman's Narrative* and proved that the James Maybrick "Jack the Ripper Diary" was a hoax. I worked with Joe on authenticating some artifacts from the *Titanic* and was provided with some wood slivers from the wreck as a thank you.

He was also known for his poetry, and he wrote poems beginning in the mid-1960s and continued to have them published (his most recent was published in remembrance of Mark Edward in the March/April 2025 issue of SI). He received the Farquhar Award for poetry in 1967 and rubbed elbows with such poets as Robert Creeley, Alan Ginsberg, and Wendell Berry.

Now you may be asking, how do I know all this? I was the webmaster for Joe's website from the 2000s until about 2018, and, if you ever looked at the site, you would see the most prominent feature: Joe's list of personas.

When Joe was looking for work after he returned from Canada in the late 1970s, he had a potential employer tell him that his resume looked like a joke. While in Canada, he worked many odd jobs, jumped from one to the next, and did not stay at any one job for any length of time. He then decided to knuckle down and get his English doctorate degree.

After a while, he decided to follow the writer George Plimpton's method of participatory writing—that is, actually doing the job, working in the career/vocation of what you are writing about so you can get a greater understanding. And, like many of the things Joe did, he took this to extremes.

The website listed 1,066 personas, from Accident Victim all the way to "Zombie." Most are serious, and he learned about or participated in many different activities. He was an animal trainer for a day, map illustrator, tinsmith, cooper, and cereologist, among others. A few were not so serious. We had jokingly discussed whether or not he wanted to include the persona of "air breather." He was aware that some were tenuous, but he did want to reach 1,000, which he did.

Joe was a humanist, and he was particularly proud of the following phrase he coined: "A humanist is an atheist with a heart."

Due to all of Joe's interests and experiences doing these various things and his authentication work, Joe was uniquely qualified to investigate just about anything. And while he was not computer literate (we jokingly called his office a "technology-free zone"), he was technologically proficient and was willing to consult with those who were able to help him figure out any potential issues.

I think the things he would most want to be remembered for would be his literary investigations (he found a lost literary publication as a part of his doctoral dissertation) and his authentication work, which also includes all his paranormal and miracle-claim work (which, after all, is authentication). He strictly stated he was *not* a debunker, and I think CSI and CFI have followed this philosophy: we do not want to disprove anything; we just want to find out what is really happening.

Timothy Binga is the director of Libraries at the Center for Inquiry.

Alejandro Borgo

It was a great pleasure to meet Joe Nickell in person. I met him five or six times in different countries from 1998 to 2006. I visited his office in Buffalo, full of books, dolls of aliens, and various "monsters." Joe wrote hundreds of articles for SI and stacks of books on various subjects related to paranormal mysteries.

He was a relentless researcher. I remember his affability, cordiality, sense of humor, and willingness to talk. He was always willing to discuss "difficult" subjects, and we laughed a lot. When he was in Buenos Aires, we went to eat at several restaurants, and he would always look at the saltshaker and say, ironically: "no pepper." So, I would ask for it.

One day I went for a walk down the traditional Florida Street with him and Ben Radford, and we encountered a tango dance performance. The female dancer saw Joe, grabbed him by the neck, and planted a kiss on his mouth, leaving his lips red. Joe didn't flinch and instead gave her a defiant look. That was Joe: he didn't lose his composure.

When I met him, I asked for his email, and he said he didn't have one. For the Critical Thinking Conference held in Buenos Aires in September 2005, he asked me for a slide projector—and this was when PowerPoint was in full swing! Really, an interesting guy. I spent years reading his excellent articles. We will

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CFI Press Release with Reflections from Barry Karr, Kenny Biddle, and Robyn Blumner

Joe Nickell, the award-winning investigator and longtime Skeptical Inquirer columnist, died March 6, 2025, at the age of eighty. In addition to decades spent investigating historical, paranormal, and forensic mysteries and hoaxes, Nickell was a prolific author whose work was frequently cited in news reports and documentaries. All of us at the Center for Inquiry are saddened at the sudden loss of our long-time colleague.

"Joe Nickell was an icon and hero within the skeptical community," said Barry Karr, the executive director of the Committee for Skeptical Inquiry (CSI). "Joe was a hands-on investigator who could be found aboard the Queen Mary looking for alleged ghosts, or in a farmer's field investigating crop circles, or roaming the shores of Loch Ness looking for Nessie, or touring China studying traditional Chinese medicine and examining the claims of Qigong masters. This barely scratches the surface.

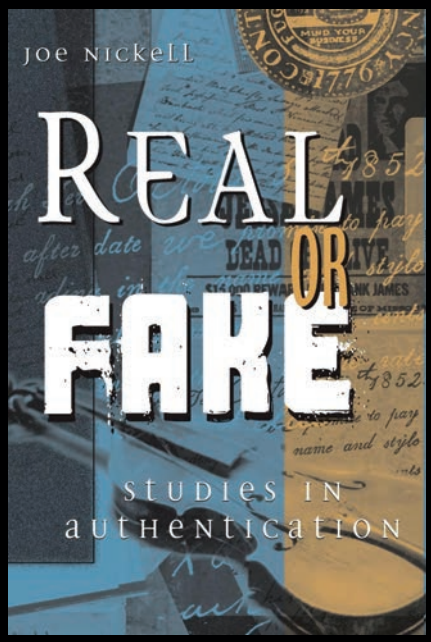
"Joe was a true polymath who often left you in awe of his depth of knowledge in, it seemed, a limitless number of subjects. He was a walking and talking encyclopedia with a never-ending curiosity to know even more and bring on the next mystery!" Karr said. "What a tremendous loss. He can never be replaced."

Nickell wrote his first article for Skeptical Inquirer magazine in 1983. He was elected as a fellow of the Committee for Skeptical Inquiry in 1988 and became a member of CSI's Executive Council in 1993. Nickell was named a CSI senior research fellow in 1995, the same year he began writing his "Investigative Files" column for Skeptical Inquirer. Nickell was known for many years as "the world's only full-time professional paranormal investigator."

Kenny Biddle, who now serves as chief investigator for CSI, said, "Joe went from being a mentor, to a colleague, and eventually to a friend. The knowledge he shared with me was not only invaluable but certainly had a part in shaping how I approach investigating paranormal claims. I will miss his visits and stories but will never forget the knowledge he passed on to me. Thank you, Joe."

Nickell was born on December 1, 1944, in West Liberty, Kentucky. His long and varied career included work as "a stage magician, carnival pitchman, private detective, blackjack dealer, riverboat manager, university instructor, author, and paranormal investigator." Over the course of more than fifty years, Nickell authored dozens of books on topics ranging from investigating ghosts and cryptids to authenticating historical documents and examining ancient religious artifacts. Nickell and his work were honored with numerous awards, including CSI's Distinguished Skeptic award in 2000 and the Robert P. Balles Prize in Critical Thinking in 2012.

"Joe was an institution at the Center for Inquiry, and his investigations into paranormal claims were often groundbreaking," said CFI President and CEO Robyn Blumner. "Joe's contributions to the field of skepticism were known and admired around the world. He challenged fraudsters, conmen, medical quacks, and the credulous in a way that will not soon be forgotten."



Kenny Biddle and Joe at CSICon 2018

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certainly miss him.

Alejandro Borgo is the editor of *Pensar* magazine, the director of the Center for Inquiry Argentina, and a CSI fellow.

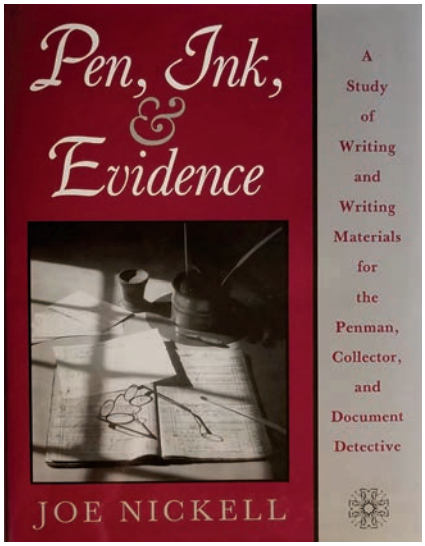
Bryan Farha

I met Joe in August 2005 in Washington, D.C., where we were both being interviewed for a National Geographic Channel television show. We had a few meals together at the hotel and these conversations revealed what a quality person this man was. I was new to national TV interviews, and—with a few pointers—he helped minimize my stress, which I'm grateful for. Joe also gave me his unique round, wooden business card—resembling a casino chip—that read "Don't Take Any Other Wooden Nickel" (the flip side contained his business information). I still have it to this day and will keep it forever. Wish we could do the same with Joe.

Bryan Farha is an emeritus professor of behavioral studies in education at Oklahoma City University and a CSI scientific and technical consultant.

Chris French

I only had the good fortune to meet Joe Nickell in the flesh on two occasions. One of those occasions was when I visited the CFI headquarters in Amherst in 2011. I actually got to visit the very office where he worked and wrote all those amazing books. Obviously, as a skeptic, I don't buy into the idea of holy ground—but I came close on that occasion. The



other occasion was, I believe, at a European Skeptics Congress (I can't remember which one). My wife and I spent a very enjoyable evening listening to Joe recount a small sample of the adventures that made up his amazing life—and, at the end of it, he presented us both with one of his famous wooden nickels.

Despite only meeting him in person on those two occasions, I felt I knew him well through his books. I have lost count of the times I reached for one of Joe's many volumes before taking part in some media discussion on this or that paranormal topic. His legacy will live on through his books for generations to come. He was truly a legend among skeptics, and he will be greatly missed.

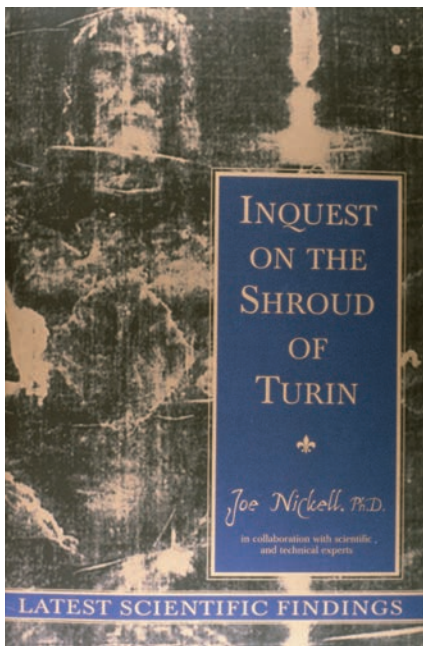
Chris French is an emeritus professor of psychology at Goldsmiths, University of London, and a CSI fellow.

Luis Alfonso Gámez

Finding the wooden nickel that Joe used as a business card was one of the most beautiful moments of my recent office move. It had been so well kept among my memories for years that I didn't know where it was. He gave it to me in Buenos Aires in 2005 during the First Ibero-American Conference on Critical Thinking.

We met in 1997 in La Coruña, Spain, at the VII European Skeptics Congress. I interviewed him for my newspaper, focusing on the Shroud of Turin. When I told him that he was "an expert on paranormal phenomena related to religion," he replied: "I don't consider myself an expert." That day, September 5, 1997, Joe inscribed my frequently consulted *Inquest on the Shroud of Turin* to me. The next day, he broke his right ankle after a visit to the Cathedral of Santiago de Compostela, an accident that complicated his life for a while. We met again at other skeptical conferences, and he always greeted me warmly, was patient with my poor English, and talked about the paranormal.

Joe is part of that small group of giants of skepticism that time is inexorably stealing from us: Kendrick Frazier, James Randi, Martin Gardner, and Paul Kurtz. My wooden nickel is now in a display case in my office, next to James Randi's amazing deck. My wife's wooden nickel—she received one as well in Buenos Aires and was captivated by



Joe's compassion and wisdom—travels with her on her journeys. We both know we were lucky to have crossed paths with Joe in this world.

Luis Alfonso Gámez is a journalist and CSI scientific and technical consultant.

Rosemarie Giambrone

About ten years ago, my eldest grandson, who is almost twenty years old now, was an extremely bright and curious boy. He had been to my office a few times and was always fascinated by the contents of Joe's office. Joe, never being one to deny a visitor, would always welcome him in and then proceed to answer question after question for as long as time permitted.

My grandson was particularly interested in crop circles. One day, Joe handed him a book on the subject and invited him to come back to read it anytime he liked. You see, he didn't want books leaving his office. Then they moved onto magic tricks and ghosts, among other things.

So began their friendship. I would bring my grandson in, along with two cheeseburger meals from McDonalds, and after they had their picnic lunch, they would pick up wherever they had left off on the last visit. This became a regular occurrence whenever my grandson had a day off from school—one he looked forward to all the time.

Rosemarie Giambrone is the development assistant for the Center for Inquiry.

Julia Lavarnway

Some authors are antagonistic toward copy editors, fearing they will distort their meaning or bury their voice (not an unfounded fear sometimes, unfortunately). When I first started working with Joe Nickell in 2006, we had a bit of that relationship. I thought he was super arrogant and unwilling to be collaborative. What I didn't realize—being twenty-two, so naturally thinking I knew everything—was that I was so green behind the ears it was hard for such a seasoned writer to take me seriously. But I think we both learned from each other over the next two decades. Joe helped me become a better editor: among other things, he taught me what a comma splice is—one of my biggest pet peeve errors to this day. And I like to think I taught him a thing or two about editors and writers being on the same side: we both want the piece to be the best it can be for the sake of the readers. Our relationship started out a bit rocky, but by the time he died he would often tell me he trusted my judgment. And if you knew Joe, you know what a huge compliment that was.

Julia Lavarnway is managing editor of Skeptical Inquirer.

Stephen Law

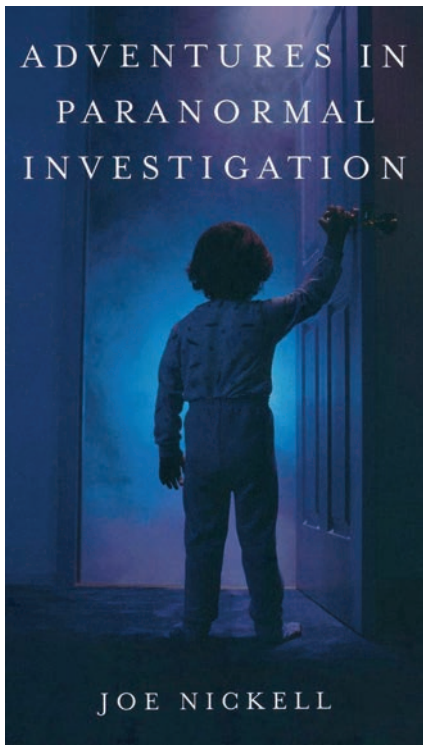
I have very fond memories of Joe. I met him at CFI headquarters in Buffalo way back when Paul Kurtz was in charge. Joe was funny, warm, and kind. His amazing collection of artifacts kept me entertained for quite a while, and I even received one of his wooden nickels, which I later lost—dammit. Whenever I've come across something written by Joe, I've read it eagerly because he never fails to be interesting, illuminating, and entertaining. He is a huge loss to the skeptic community.

Stephen Law is a professor of philosophy at Oxford University and a CSI fellow.

Nikil Mukerji

Joe Nickell's work has served as a beacon for those who value curiosity and critical inquiry. Although I never got the chance to meet Joe personally, his many writings—especially his wonderful 2007 book *Adventures in Paranormal Investigation*—have had a lasting impact on how I approach the unexplained. Joe showed us, again and again, that be-

Joe in his office circa 2013. Credit: Susan Gerbic



Joe learning an asteroid was named after him in 2011 (with Bill Nye and Major James McGaha). The asteroid, 31451Joenickell, was thought to be partly made of nickel.

hind every strange and spooky story is a logical explanation just waiting to be uncovered. His warmth, dedication, and careful attention to detail not only made sense of paranormal claims but also encouraged a whole new generation of skeptics to stay curious and thoughtful. I'm truly grateful to Joe for lighting the way for all of us who care deeply about finding truth in a world full of mysteries.

Nikil Mukerji is a member of GWUP (Germany) and a CSI fellow.

Jan Willem Nienhuys

Joe Nickell has been one of my heroes and an inspiration too, but my first clear memory of talking to him was at the European 1997 skeptical congress in La Coruña in Spain. After a Saturday bus tour to nearby Santiago de Compostella, we prepared to attend the congress dinner. When we left the hotel to walk to the venue, Joe stumbled on the granite steps and broke his ankle. He was rushed off to a local hospital. The next day I visited him there, and we talked a lot. Later he told me that back in America, the surgery on his ankle had to be redone. It was very distressing.

In 2002, our Dutch magazine *Skepter* started a new format, and I had asked Joe, at another skeptical conference, whether he would be willing to write a regular column for us. We were very glad when he promised to do so. Altogether, he wrote eighteen columns exclusively (I think) for us.

In 2006, he was the first speaker at our skeptical congress on the paranormal. In the week leading up to that event, I took him to visit various Dutch folkloristic, religious, and paranormal sights. One of them was the statue of Hans Brinker, a boy who only existed in a nineteenth century American children's novel (see his article in the November/December 2007 issue of SI). Of Joe's talk at the congress, I most vividly recall his introduction: "Many presentations are just thinly disguised book promotions. This talk is no exception."

His last column for us, about incompetent fortune tellers, was in 2007. He had investigated many of these, and he mentioned that none of them had told him that he had a daughter and two grandsons (who discovered him in 2003).

Jan Willem Nienhuys is a book translator and CSI fellow.

"In an era where misinformation and conspiracy theories spread like wildfire—sometimes even espoused by elected officials—Nickell's rational, methodical approach to investigating extraordinary claims will be sorely missed."

—**Jeff Dupuis** in *The Superstitious Times* (from "Joe Nickell, Renowned Paranormal Skeptic and Investigator, Dies at 80" at superstitioustimes.com)

"I will miss Joe Nickell's candle in the dark. His yeoman's work, as he called it, will outlive him, as will his tales."

—**Jonathan Jarry** writing from the Office for Science and Society of McGill University (from "Remembering Joe Nickell, Skeptical Icon" at mcgill.ca)

"Now he's taken on his final persona in our relationship—Joe Nickell, the friendly skeptical ghost who will haunt me with his wisdom and his adventures for the rest of my own life."

—**Blake Smith** in *The Skeptic* (UK) magazine (from "Joe Nickell, Legendary Skeptical Investigator, Dies at the Age of 80" at skeptic.org.uk)

Bill Nye

Before I ever met Joe Nickell in person (and received one of his wonderful wooden nickel business coin-cards), it was Joe's analysis of the Shroud of Turin that got me. Joe's investigation (debunking) of the old rag was and still is thorough and brilliant. He proved, in his steady patient fashion, that the image on the sheet was manufactured in the 1300s, with materials and techniques of the time. Done. Close the case. But of course, it still bounces around certain sectors of the world even today. As readers here are probably well-aware, Joe was good at debunking (*investigating* in his parlance) all manner of odd claims, but his specialty was extraordinary medical claims. Wow, do we need more of that today! Whatever the claim, Joe came at the problem with remarkable open-mindedness along with clear-eyed skepticism. I studied Joe's moves. We all should. He came at each extraordinary claim with patience and reason, a skill needed now more than ever. He was an extraordinary man. He will be missed.

Bill Nye is a science communicator and CEO of The Planetary Society.

Carlos Orsi

Joe Nickell's career in skepticism made my career in skepticism possible. When I decided to write my first skeptical book in 2011, Nickell's work became the backbone of my research. Of course, there's a lot of philosophical talk on miracles. But for hands-on experience and level-headed, uncompromising analysis of particular cases, from Turin's Shroud to Guadalupe's Image, there is Joe Nickell. Period. Not only did his case studies become part of my research, his approach taught me how to deal with my own. I only met Joe personally once, at CSICon 2018, and thanked him. He gave me one of his wooden nickels. I keep it in my small collection of unusual currency, beside a British commemorative Sherlock Holmes 50 pence piece. They go well together.

Carlos Orsi is a journalist and the chief editor of Brazilian skeptic publication *Revista Questão de Ciência.*

Joe speaks spooky messages through a spirit trumpet to Massimo Polidoro.

Joe and Ben Radford planning a Lake Monster Investigation. Credit: Andrew Skolnick

Massimo Polidoro

Joe Nickell was a very rare human being. A master sleuth whom anyone interested in the investigation of mysteries should read and study, for he has much to teach. He particularly liked the description I gave him: "Detective of the Impossible."

"I think my most distinguishing childhood trait was curiosity—mine was insatiable—and mysteries invite just that trait," he once told me. "I learned from the Sherlock Holmes stories that mysteries were meant neither to be fostered nor dismissed but carefully investigated with the intention of solving them. By the age of eight, I knew I wanted to be a detective."

Joe was among the first people I met—along with Jim Alcock, Ray Hyman, Barry Karr, and Paul Kurtz—when I came to the United States in the late 1980s to become Randi's apprentice. We immediately struck up a friendship, rooted in our shared passion for mysteries and magic, that lasted throughout his life. Every time we met, whether to recreate a Houdini séance, investigate the tomb of the "Voodoo Queen" Marie Laveau in New Orleans, or explore some hidden labyrinth beneath the streets of Budapest, spending time with him was always a joy. He possessed a great sense of humor and self-irony and always shared fascinating stories of his investigations.

Joe might occasionally seem a little sharp around the edges, perhaps giving the impression he was putting on airs—but if you caught the twinkle in his eye, you knew he was mostly teasing. And once you understood that, there was nothing but delight in his company.

When I asked him what gave him the most satisfaction, he said: "Among my happiest moments are when I believe I have solved a mystery and satisfied not only my curiosity and that of others, but also hopefully added to mankind's knowledge. It is a pleasure that must elude mere dismissers and debunkers."

Farewell, my dear friend—may your curiosity and passion for truth continue to inspire all those who seek to unravel the world's mysteries.

Massimo Polidoro is the executive director of CICAP (Italy) and a CSI research fellow.

Benjamin Radford

I was in the Bermuda Triangle—not far from the Gulf of Mexico—on a cruise when I got the news that Joe Nickell had died. Joe was my colleague, collaborator, and coauthor for more than a quarter of a century at CSICOP, now CSI, and SI magazine.

There are countless brilliant people affiliated with the organization, a phalanx of notable psychologists, magicians, anthropologists, science writers, statisticians, philosophers, physicians, astronomers, and others. But there are relatively few people who actively and regularly investigate paranormal claims; they—*we*—are rarities even in the small skeptical community.

I dedicated one of my books "For Randi and Joe—the best of the best." Joe was indeed one of the best—as he'd often remind anyone within earshot—but in his case, it wasn't idle boasting; it was true. I had the privilege of knowing and working with both James "The Amazing" Randi and Joe on occasion—though as Randi had formally parted ways with CSICOP some years before I started, it was mostly with Joe. Where Randi tended to focus on intricate, long-term investigations (Project Alpha, Uri Geller, and fraudulent faith healer Peter Popoff among many others), Joe was more of a generalist. While he had a few long-running, in-depth specialties (e.g., the Shroud of Turin and weeping icons), he tackled pretty much any topic you could think of from ghosts to healing waters to Mothman.

Note

Benjamin Radford's full tribute to Joe Nickell, titled "The Joe I Know," is available at skepticalinquirer.org.

Benjamin Radford is the deputy editor of Skeptical Inquirer and a CSI research fellow.

Richard Saunders

Many years ago when Joe visited Australia, he asked me what he should take with him when investigating reports of our river monsters. "A very large net!" I replied. Joe's smile spread across his face and turned into a hearty laugh. I looked forward to my encounters with Joe, mostly at The Amazing Meeting, where I would copy his outfit—black trousers, blank shirt, and white jacket—and we would pose for photos. Just for fun? No, behind it was a deep respect for the man and his work. Imitation is the sincerest form of flattery, and I continue to honor the man via my work and investigations.

Richard Saunders is the chief investigator for Australian Skeptics Inc. and a CSI fellow.

Eugenie C. Scott

My first memory of Joe is the two of us sitting in a sunny, grassy spot on the campus of the University of Kentucky in about 1980. He was a graduate student in English, and I was an assistant professor in the anthropology department. The Lexington school board had decided that teachers should "balance" the teaching of evolution with "creation science," and I was one of the organizers of the campus response. Joe wanted to help—and did. He wasn't a scientist, and he didn't have a lot to say about the specific "scientific" claims of the creationists, but he was a critical thinker. His strength was his ability to analyze the structure of arguments used by creationists—the cherry-picking, faulty logic, and rhetorical packaging of their arguments. His 10,000-foot view was grounding: we scientists were inclined to obsess over the scientific errors of our opponents ("But that's a misstatement of the Cambrian Explosion!") while neglecting to point out their larger problems. Even back then, his affect would have been familiar: reasonable and informed in content, and polite and nonjudgmental toward our opponents, just like he treated anyone who disagreed with him. He was a valuable ally.

As we talked that afternoon in the sunshine, we learned that both of us had discovered the skeptics movement, and he introduced me to the great early skeptic Bob Baker, at the time a professor of psychology at the University of Kentucky. Of course, Joe himself went on to become one of our greatest skeptics, as everyone reading these tributes knows. Like all of you, I learned a lot from him, and I will miss him greatly.

Eugenie C. Scott is the founding executive director of the National Center for Science Education and a member of CSI's executive council.

Seth Shostak

Whenever I got hold of the latest issue of SI, I would first turn to the essay by Joe Nickell. That's because they were always personal and always compelling. He had worked in carnivals and was familiar with the ways in which the public could be

Joe (right) during TAM9 in 2011, with Richard Wiseman and Phil Plait. Credit: Erlend Aakre

The New York Times

Joe Nickell, Paranormal Investigator and 'Real-Life Scully,' Dies at 80

A professional skeptic, he took on hundreds of mysteries, offering rational explanations for the Loch Ness monster, the Shroud of Turin and countless hauntings.

fooled, so his articles were a bit like having lunch with Houdini: the celebrated magician talked to you about how magic really worked. Joe gave us a peek behind the curtain, not with the intention of blowing an illusionist's cover but simply to show us how seeing shouldn't always lead to believing.

Seth Shostak is a senior astronomer at the SETI Institute and a CSI fellow.

Tim Trachet

It was for me always a pleasure to meet Joe Nickell at several international meetings, but I had the opportunity to know him better when he visited Belgium in 1998, because I was host of our skeptical organization SKEPP. He gave lectures in Brussels and Ghent, including one for students at Ghent University. Because he was interested in miracles, we visited some more or less "miraculous" places in my country, recognized by the Catholic Church: the Basilica of the Holy Blood in Bruges, the Basilica of Scherpenheuvel and the (imitation) Lourdes Grotto with its accompanying basilica in Oostakker near Ghent. In the latter location, a recognized Lourdes miracle took place in 1874 when the broken leg of a man healed in an "inexplicable" way. Joe found it all interesting. Much later, in 2010, he published an article about those places in SI.

The last time I saw Joe was in 2010 at the European Skeptics Congress in Budapest. I gave a lecture on miracles, which clearly pleased him. At that conference he presented, together with skeptical Italian chemist Luigi Garlaschelli, a replica of the Shroud of Turin. Garlaschelli made this cloth with accompanying figure based on a method that Joe had already tried in 1983. It was an interesting—and also hilarious—moment, as the "shroud" was very realistic.

Tim Trachet is an honorary chairman of SKEPP (Belgium) and a CSI scientific and technical consultant.

Richard Wiseman

Most of us go through life ploughing the same furrow. Not Joe Nickell. In his younger years, he traveled to Afghanistan, worked as a private detective, trained as a stuntman, and spent several months dealing blackjack in Yukon's Dawson City. He also had a lifelong fascination with magic, amazing customers at the Houdini Magical Hall of Fame in Niagara Falls, making people smile as Mister Twister the Magic Clown, reading minds as Mendell the Mentalist, and stunning schoolchildren as Janus the Magician. Later, he developed a deep interest in the paranormal and wrote an impressive number of books and articles about his many hands-on investigations. Throughout it all, Joe always had the courage of his convictions. It would have been easy to make more money by declaring that paranormal phenomena exist, but Joe was never convinced and so remained devoutly skeptical. Similarly, as an outspoken critic of the Vietnam War, he lived as a federal fugitive in Canada for many years until being pardoned by President Jimmy Carter. I first met Joe in the early 1990s at CFI, and over the years we chatted at conventions, visited the Spiritualist encampment at Lily Dale, and investigated a carpet that was claimed to have paranormal properties (it didn't). He described himself as having over 1,000 personas, but I found the real Joe Nickell to be far more caring, quirky, fragile, and interesting than any of them.

Richard Wiseman is a professor of the public understanding of psychology at the University of Hertfordshire in the United Kingdom and a CSI research fellow.

Joe and his wife, Diana, getting engaged at a carnival in Springfield, Illinois.

Watch Joe Nickell's CSICon talk—"Investigating vs. Debunking." Scan the QR code below, or visit centerforinquiry.org.

[INVESTIGATIVE FILES JOE NICKELL

Joe Nickell, PhD, was an inspiration for *The Reaping* (2007), a Hollywood movie about miracles. He was interviewed by script writers, and Warner Brothers bought copies of his book *Looking for a Miracle* (1993) for the actors. He was then flown to the Louisiana movie set to meet Oscar-winning actress Hilary Swank and watch filming.

Miracle Boy? The First Millennial Saint

Editor's note: In addition to the many tributes to Joe Nickell in Skeptical Inquirer, this issue also shares the distinction of including the last file in his "Investigative Files," a column that has explored mysteries—old and new—for thirty extraordinary years. This last column was submitted and accepted prior to his death.

Carlo Acutis was a Catholic child in Milan fascinated by his church's claims of miracles and their supposedly supernatural powers. These included apparitions of the Virgin Mary, alleged healings, and reputedly inexplicable events associated with the Eucharist (the consecrated bread and wine of Communion).

Despite his church's touted healings, at age fifteen he died miserably from leukemia. Ironically, however, it seems that if he could not receive a miracle, he could yet somehow magically *cause* them—even on the other side of the world. The mother of a Brazilian boy with an unspecified "pancreatic disease" reported that she had prayed to Acutis for his help and her son was "miraculously healed" (Swain and Swain 2021, 11). But what really happened?

Miracle Obsession

Carlo Acutis (May 3, 1991–October 12, 2006) lived most of his life in northern Italy, mostly Milan. (We may have come quite near to each other in 2004, when I did some investigative work—traveling by train from Venice, Milan, and eventually Turin [Nickell 2007, 27–28].) Acutis was fascinated by miracle claims, especially those involving the Eucharist.

The Eucharist involves the incredible (as in *not credible*) claim of *transubstantiation*, the concept that the bread and wine are transformed into the body and blood of Jesus. However, the sense is not symbolic, as in Jesus's words at the Last Supper (e.g., Matthew 26:26–29). Rather, the belief in Catholic and some other Christian churches is that the bread and wine are *transformed* into the actual body and blood of Jesus—although it may be allowed that the appearance remains the same.

Pontifical Mass of Carlo Acutis with The Blessing of The New Shrine. Credit: Mazur | cbcew.org.uk | Flickr.

History is instructional on this; many of the Eucharistic miracle stories have suspiciously similar plots, suggesting derivation. For example, at least three stories—from Lanciano, Italy, c. 750; Regensburg, Germany, 1257; and Bolsena, Italy, 1263—concern a priest who had doubts about the reality of transubstantiation, but then when he spoke the words of consecration, the host (the consecrated bread or wafer) was suddenly transformed into flesh and/or the wine became visible blood (Cruz 1987, 3–7, 59–62).

As another example, several tales—from Alatri, Italy, 1228; Santarem, Portugal, early thirteenth century; and Offida, Italy, 1280—feature a woman who kept the host in her mouth so she could make off with it, and, as instructed by some occultist, transform it into a love potion. Subsequently, the host was turned into flesh (Cruz 1987, 30–37, 70–83). In one instance, it also issued a mysterious light (Cruz 1987, 38–46). (See also Nickell 2012, 90–97.)

To give one more example of a questionable Eucharistic miracle tale, the host was reputedly multiplied into some twenty hosts, enough to serve almost 600 people. It obviously recalls Jesus's miraculous feeding of the multitude (Matthew 14:15–21). Interestingly, the feat was accomplished by St. John Bosco (1815–1888), who in his youth had been a performing magician (Cruz 1987, 208)! Believe it or not! And thus, John Bosco was made into a saint.

Do Miracles Exist?

It is important to note that mainstream science has never established the existence of anything supposed to be supernatural. That term denotes its presence is *outside* the natural world, and its very existence is unproved and unlikely.

Of course there are myriad *claims* of the supernatural, but they do not withstand truly scientific scrutiny. Typically, it is claimed that some alleged miracle "cannot be explained," but that is an unsatisfactory definition. It depends not on positive evidence for an event but on its being inexplicable. Such a claim is based on a logical fallacy called arguing from ignorance, that is, from a lack of

Tomb of Carlo Acutis at the Sanctuary of the Spoliation in Assisi, Italy. Credit: Dobroš | Wikipedia.

knowledge. One cannot insist, for example, that we don't know what caused someone's cancer to go into remission and then conclude that it was therefore caused by "a miracle from God."

In more than half a century of investigating supernatural claims, I have attempted to keep an open mind, however, and not be quick to render a judgment. I have tried to discover the best evidence and let it lead to the most likely solution, using established principles of scientific inquiry. For example, the principle of Occam's razor holds that, all else being equal, the explanation with the fewest assumptions is to be preferred (Nickell 2013, 15).

For example, I showed that religious statues at a Marian apparition site in Conyers, Georgia, did not have heartbeats as alleged. Instead, no such effects were detectable by stethoscope (as was pictured somewhat humorously by a photo of me examining them). In fact, people were reaching up to feel the throbbings and were instead either feeling the pulse in their own thumbs or experiencing the frequent effects of pious imagination (Nickell 2013, 60).

A very instructive case occurred in Toronto in 1996 with a "weeping icon" at a Greek Orthodox church. I was invited by the *Toronto Sun* and followed into the church by one of the paper's photographers. I was not then permitted to touch the icon or take samples, but I nevertheless made important discoveries. First, the icon itself was a fake—not an original wood-panel painting at all but merely a color photographic print. In addition, the "tears" did not emanate from the eyes but from somewhere near the top of the Virgin's head, so by definition the image was not "weeping." Moreover, one of the tear rivulets was smeared and looked (as I told the *Sun*) "suspiciously oily."

In time, attention focused on the priest there, who had also preached at a cathedral in Queens, New York, where there had been a scandal over a crying icon. On August 27, 1997, I was invited back to the Toronto church. This time the invite came from the parent Orthodox Church authority itself after donor money went missing—along with the priest. A carpenter was appointed to assist me, and we dismantled the framing the picture had acquired. With a police guard outside and a fraud-squad detective standing by, I carefully took samples of the oil and signed them over to the detective for testing by the police laboratory. While the oil did prove to be a nondrying variety commonly used for such hoaxes, there was no way to prove just who put it on the picture. (I was subsequently featured—with an actor playing me in re-creation scenes—on a 2017 episode of *Mysteries at the Museum* [Nickell 2013, 65–68].)

Acutis's Final Year

Much of Carlo Acutis's work collecting miracle claims had been done in his last year of life when he was fifteen. The year was 2006, and on the first day of October he suffered a throat inflammation that a doctor diagnosed as parotitis and dehydration, which was confirmed by another doctor. However, a few days later at a clinic specializing in blood diseases, he was diagnosed with the illness that would take his life.

Acutis had acute promyelocytic leukemia, and his condition worsened quickly. On October 10, he was given the Sacrament of the Anointing of the Sick (no longer called *extreme unction*), and the very next day, October 11, he lapsed into a coma and was pronounced brain dead. He died the day after that on October 12. Acutis's wish had been to donate his organs, but they had been ruined by the leukemia ("Carlo Acutis" 2024; Acutis 2021, 20–21).

Acutis's family was somewhat surprised when there came public calls for him to be recognized as a saint. Of course, he would first need to be named a Servant of God. Next a miracle would need to be declared, and Acutis would have to consequently be beatified (declared "blessed"). Finally, a second miracle would have to follow for him to be canonized (declared a "saint" of the Catholic Church). As the old saying goes, however, where there's a will, there's a way. He would in time become, as indicated by the title of a book about him, *The First Millennial Saint* (Gori 2021).

The designations would come—almost predictably—in time. The Church would listen to calls from the public, and soon a "miracle" would be claimed and "investigated," followed by another, in the historical manner we have already seen.

Acutis's Alleged Miracles

After Acutis was formally recognized as a Servant of God in 2013, a three-year-old boy in Brazil named Matheus Vianna was "miraculously healed"—or so it was claimed. Since his birth in 2010, he had suffered from digestive disorders due to a congenital malformation of his pancreas. His mother, Luciana, was praying constantly for him.

There are different stories about the child's alleged healing. A swatch of fabric from Acutis's clothing had been displayed at a feast to be kissed or otherwise treated as a relic (Mares 2023, 119–122). A *relic* is an object once connected with the body of a saint, martyr, or other holy person. (A cult of relics eventually developed historically, and famously faked relics became widespread.) In Catholicism today, relics are widely believed to be imbued with supernatural powers that effect healings and other miracles; see my 2007 book *Relics of the Christ*.

It was in this tradition that the "relic" from Acutis's clothes was pointed out to the little Brazilian boy, who—doubtless doing as he was instructed—kissed the swatch and said aloud, "Stop vomiting!" Now whether the boy's alleged healing was caused by his mother's extensive prayers or by his one-time kissing of Acutis's relic, the story was put out that the boy was healed as a result (Mares 2023, 119–122). And so Acutis was beatified.

Needed for canonization, a second miracle claim was attributed to the intercession of Carlo Acutis. This occurred in 2022 when a woman from Costa Rica fell off her bicycle and suffered a brain hemorrhage. Doctors were said to have given her low odds for survival. But after her mother prayed to Acutis and visited his tomb, the young woman was able to breathe independently and walk; the hemorrhage had disappeared ("Carlo Acutis" 2024; Treisman 2024).

But were *suppositions* in this case merely that? Were they in error? Is it not entirely possible that the healing is simply evidence of the remarkable power of humans to heal themselves? Why shouldn't we accept this solution rather than jump to supernatural—i.e., imaginary—realms? As well, other "cures" may be attributable to misdiagnosis, psychosomatic conditions, prior medical treatment, and other effects.

Also consider the famous French shrine at Lourdes and the fact that some types of potential miracle healings never occur there, as indicated by the comment of French writer Anatole France. On visiting Lourdes and seeing the discarded crutches and canes, he exclaimed, "What, what, no wooden legs?" (Nickell 2013, 183–185).

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As a secular humanist, I have spent my life in around-the-world-adventures to investigate strange mysteries at the interface of science and religion. I have been honored to work with other secularists and science-based investigators, as we have dared to check our emotions and rely on reason and evidence. As I have long held, we live in a real and natural world, and the progress of science is a series of solved mysteries. ■

I have been honored to work with other secularists and science-based investigators, as we have dared to check our emotions and rely on reason and evidence. As I have long held, we live in a real and natural world, and the progress of science is a series of solved mysteries.

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[NOTES ON A STRANGE WORLD MASSIMO POLIDORO

Massimo Polidoro is a writer, lecturer, investigator of the unusual, and cofounder of CICAP, the Italian skeptics group. His YouTube channel is at @Massimo_Polidoro.

Driven to Believe: We Are Designed for Self-Deception

At the 100th floor of Manhattan's 30 Hudson Yards, "The Edge" offers a spectacular view over New York City. It is the highest outdoor sky deck in the Western Hemisphere, surrounded by glass walls and, in some sections, featuring a transparent glass floor that reveals the city below in dizzying detail. People look like ants. The experience is safe, of course—but not everyone can bring themselves to walk on that glass.

I watched visitors approach, then recoil. Some refused to take even a single step forward. They *knew* it was safe, and yet they couldn't help but feel it wasn't. I had to summon my own courage to step on it.

Philosopher Tamar Gendler of Yale University encountered the same reaction while observing visitors at the Grand Canyon Skywalk. To describe the strange conflict between what people *know* and what they *feel*, Gendler coined a term: *alief*. While *belief* refers to what we consciously accept as true, *alief* describes a more primitive response, based on how things *appear or feel* rather than how they actually *are* (Gendler 2009).

When we stand on a glass platform 100 floors above the ground, we *believe* we are safe—but we *alieve* we are in danger.

Alief helps explain why our emotions can overpower our reason. It's the same reason we jump at horror movies. We *know* it's fiction, but our hearts race and our bodies tense as if it were real. The reaction is genuine, though the threat—we know—is not.

This doesn't just happen with heights or scary movies. I have experienced it in deeply personal moments too. After my father died, I *knew* he was gone. Yet, sometimes, I would feel as if he were watching over me. Rationally, I rejected the idea but emotionally it felt real.

Alief is not a full explanation, but it names something real: the dissonance between knowing and feeling.

But why do we have this capacity in the first place? Cognitive psychologist Justin Barrett of Oxford has proposed one answer. He suggests that humans evolved with a hyperactive agency detection device (HADD)—a mental mechanism designed to identify agents, or intentional beings, even when they are not there (Barrett 2004). Better to mistake the wind in the grass for a predator than fail to notice a lion stalking you. The cost of a false positive is minor, while the cost of a false negative could be death.

Anthropologist Pascal Boyer expands on this, noting that our minds are wired with a "better safe than sorry" logic (Boyer 2002). We instinctively detect purpose and intentionality all around us. A crack in the night isn't just noise; it *might* be someone lurking. A strange shadow on your arm might be a deadly spider. Often we're wrong—but sometimes we're right. And from an evolutionary standpoint, that's all that matters.

As philosopher Sergio Fabio Berardini has argued, our ancestors needed to interpret the intentions not only of other humans and animals but of nature itself: clouds, rivers, and stars (Berardini 2015). The jump from seeing intention to imagining gods was both short and useful. If these agents could be influenced through ritual or prayer, then perhaps nature itself could be tamed. This illusion of control became a survival tool.

It is in this context that our tendency to believe—to see patterns, messages, and meaning where none exist—becomes clear. We are not only *capable* of deceiving ourselves. We are *designed* for it.

Our emotions don't always follow our knowledge. Often they follow our instincts, which were shaped by millions of years of evolution in a world very different from today's. That is why, even now, we may feel someone is watching us, that there's a plan behind every random event, or that we're never truly alone.

We know better. But we still *alieve* otherwise. ■

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[BEHAVIOR & BELIEF

STUART VYSE

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Fear of Flying and the Search for Gate 13

While traveling, I've made a small hobby of noting whether any airport I'm passing through has a Gate 13 or not. Many elevator riders have noticed that apartment buildings, hotels, and commercial structures often "skip" the thirteenth floor. As I reported in an earlier column (Vyse 2020), "According to a 2015 story in the *Atlantic* (published on Friday, February 13!) the real estate website CityRealty.com conducted a study of 629 condominium buildings in Manhattan that had thirteen or more stories and discovered that 91 percent omitted the thirteenth floor, labeling it fourteen or other variants, such as 12B or 14A" (Li 2015). The decision to avoid accurately labeling the thirteenth floor is undoubtedly a simple business decision. Why deal with the rare individual who would be put off by buying or renting on the thirteenth floor when you can just call it the fourteenth floor?

The symptoms of *triskaidekaphobia*—a phony diagnosis probably invented by a journalist—while not as common as in tall buildings, are often detected in airports. The highest gate number of the single terminal of my home airport, T.F. Green (PVD) in Providence, Rhode Island, is 22, but because there is no Gate 13, the number is something of a lie. Many other airports show similar evidence of innumeracy.

Two features of air travel make it different from renting or buying real estate with respect to fear of thirteen. First, your exposure to the unlucky number is usually short term. You may wait at your gate for an hour or so before flying, but then you are on your way, off to another city and another gate. This brief exposure to the dreaded

Gate 14 at Osaka International Airport (Itami Airport). Although Gate 14 is shown here, Itami Airport does have a Gate 13. Source: Suikotei, Wikipedia.

digits should limit the need for bowing to superstition, but a second factor acts in the opposite direction: Many people are quite anxious about flying. I have seen fear of flying prevalence estimates as high as 40 percent of adults, but that seems unlikely to me. The Cleveland Clinic (2022) puts the "aerophobia" rate at a more conservative twenty-five million adults or just under 10 percent. Nonetheless, that's a lot of fearful travelers, and just as real estate developers don't want to do anything to jinx a sale, airports and airlines don't want anything that might discourage flying. But how common is the absent Gate 13? If only we had a way to estimate the size of this phenomenon.

An Intrepid Traveler

Enter Paul Bogard, an engineer from the Dayton, Ohio, area who frequently travels for work. In 2013, he set out to visit 100 separate airports, a goal he completed in 2022. He set up a website (https://paulbogard.net/) to document his progress, and it eventually became a repository for a remarkable amount of airport-related information, including a map that shows all the public airports in the United States that do and don't have Gate 13s.

When I interviewed him over email for this article, Bogard said that in 2019 he was flying out of Portland, Oregon (PWM), when he noticed that there were Gates 1–12 and Gate 14 but no Gate 13. He began to pay attention to whether the airports he was visiting had a Gate 13 or not, eventually doing a comprehensive analysis of this question for all the commercial airports listed

by the Federal Aviation Administration—a Herculean effort that required him to either visit or examine the terminal maps of 396 airports. The results are plotted in Figure 1, with green dots representing airports with at least one Gate 13 and red dots representing airports that skip the number thirteen. The gray dots are airports with numbering systems entirely above or below thirteen. In the overwhelming number of cases, these gray dots are small airports that don't handle many flights per day and have fewer than thirteen gates. Most of the airports—316 to be exact—fell into the gray zone. Of the remaining eighty airports, forty-one were green, and thirty-nine were red—very close to an even split. So, the fear of the number thirteen *can* be found in U.S. airports, but it is not as pronounced as in elevators.

Bogard drew several conclusions from his research. First, there does not seem to be any geographical trend. Airports with missing Gate 13s are spread fairly evenly throughout the country, and some large airports—including Chicago's O'Hare (ORD) and Boston's Logan (BOS)—had one terminal with a Gate 13 and another that skipped Gate 13. He suggested that the presence or absence of Gate 13 might reflect the era when the terminal was built or simply the proclivities of the architects or builders. In addition, Bogard discovered that some airports skipped Gate 13 but still had a Baggage Claim 13. On his website, Bogard suggests, "Maybe people aren't worried about bad luck once they're off the plane and done with flying for the day."

Flying in Row 13

But what about after you've boarded the plane? Will you encounter the troublesome Row 13? Here again, it depends. The decision to include or not include a Row 13 in the cabin of a passenger airliner is made at the level of the airline for their entire fleet. According to an article on CrewLounge AERO (a website for pilots and flight attendants), many airlines—including Emirates, Qatar Airways, Air France, Ryanair, and United Airlines—pander to their superstitious customers by omitting Row 13 (Nguyen 2022). Some airlines carrying Italian passengers, such as Lufthansa, also skip Row 17. In Italian culture, seventeen is unlucky because the Roman numerals XVII can be rearranged to spell "VIXI" which means "my life has ended." In Asian countries, the number to avoid is four because the spoken word in Chinese sounds like the word for death. As a result, there is no Row 4 on the planes of Cathay Pacific, Thai Airways, or Singapore Airlines. If you are not triskaidekaphobic or, like Taylor Swift thirteen is your lucky number (Vyse 2019), you will be able to find Row 13 on British Airways, Delta Airlines, and American Airlines.

These superstitious associations seem a bit silly, but to me, the fear of Row 13 is particularly silly because, if the plane goes down, it is quite likely that all the rows are going with it. Gate 13 applies to an entire flight, so, in a sense, it is more understandable. But fear of sitting in Row 13, specifically, is a bit myopic. And lest I forget to mention it, flying is the safest form of travel (Ingraham 2015). You are much more likely to die driving thirteen miles to the airport than flying that distance in a plane. ■

Note

The digital version of this article includes a section titled "A Final Word about Airport Hotdogs" and can be found at skepticalinquirer.org.

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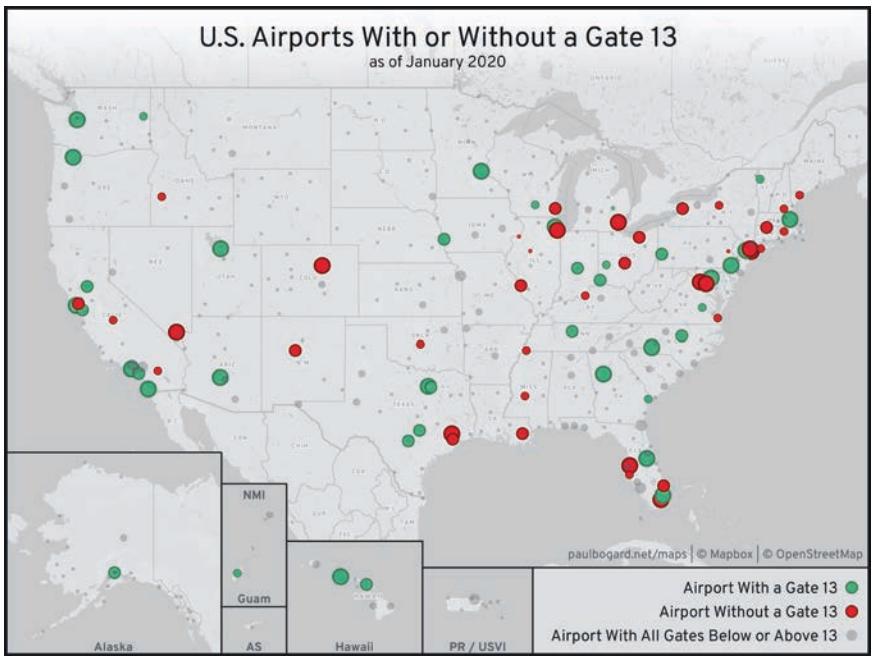

Figure 1. Map created by Paul Bogard showing all the public airports in the United States that do and do not include a Gate 13 as of 2020. The size of the airport is indicated by the size of the dot. Gray dots show airports where the range of values used to number the gates did not include 13 (i.e., all gate numbers either higher or lower than 13). Red = no Gate 13, and green = has a Gate 13. (Used with permission.)

[THE PRACTICAL SKEPTIC MICK WEST

Mick West is a writer, investigator, and debunker who enjoys looking into the evidence behind conspiracy theories and strange phenomena and then explaining what is actually going on. He runs the Metabunk forum and is the author of the book *Escaping the Rabbit Hole*.

Banning Chemtrails: Can You Legislate Away a Conspiracy Theory?

The chemtrails conspiracy theory holds that the long, white clouds we see behind planes are not—as science would tell us—ordinary condensation trails but rather some form of large-scale secret spraying being done by the government for nefarious purposes. Most commonly now, the spraying is theorized to be for weather modification and/or geoengineering.

It's a classic conspiracy theory. It makes no scientific sense and is utterly lacking in evidence. All the claims supposedly supporting the theory were raised back in the early 2000s and were explained back in the early 2000s.

But it's recently reappeared in the news. A surprising number of state legislatures have seen a rise in attempts to make chemtrails illegal. The proposed bans vary in detail and degree, but conspiracists have used the existence of the proposals to support their belief in the chemtrail conspiracy theory. After all (they reason), if nobody was spraying anything, then why would they need to ban it?

Tennessee passed legislation in April 2024. SB 2691, the Environment Preservation Act, was signed by Governor Bill Lee (R). The act "prohibits the intentional injection, release, or dispersion, by any means, of chemicals, chemical compounds, substances, or apparatus within the borders of this state into the atmosphere with the express purpose of affecting temperature, weather, or the intensity of the sunlight."

This legislation was widely interpreted as a ban on "chemtrails." The Alex Jones conspiracy site reported it in their "Good News" section as "Tennessee Senate BANS 'Chemtrail' Geo-Engineering" (Infowars 2024).

Other legislation is in progress, all in Republican-led states. Iowa's HF 191 bill bans spraying that "affects temperature, weather, or the intensity of sunlight." Kentucky has HB 22, broadly criminalizing "geoengineering," "weather modification," and "The release of an atmospheric contaminant by any human."

Other states, such as Iowa and North Dakota, simply seek to ban weather modification (e.g., cloud seeding). While less obviously an anti-chemtrail bill, these bills still seem inspired by similar concerns.

Florida, on the other hand, is very clearly taking aim at imagined chemtrails with SB 56, the Geoengineering and Weather Modification Activities Act, covering all the bases, prohibiting anything that aids "the intentional emission, injection, release, or disper-

sion of air contaminants into the atmosphere within the borders of this state when such emissions occur for the express purpose of affecting temperature, weather, climate, or the intensity of sunlight."

The Florida bills are sponsored by Illeana Garcia and Kevin Steele. Garcia explicitly stated that the bill was about "these condensation trails, aka chemtrails" and was aimed at "suspected geoengineering activities" (Tucker 2024). Steele, when asked about the rationale for the bill, repeated chemtrail talking points such as "geoengineering patents" and "toxic barium levels" that were debunked twenty years ago (see Thomas 2008, Radford 2009, and West 2024).

How did things get so messed up? The issues here revolve around several conflations and misunderstandings, some of which are shared by skeptics and journalists, making it a tricky subject to talk about. The main things that get conflated are weather modification, geoengineering, contrails, and chemtrails. The first thing a skeptic needs to do is understand exactly what those things are.

Contrails vs. Chemtrails

Contrails are simply condensation trails, clouds that form behind planes in some weather conditions due to water in the exhaust. Depending on the humidity, the trails can be short or long. If the humidity is high enough (at that altitude, not at ground level), they can sometimes spread out to form a layer of cirrus clouds.

"Chemtrails" don't really exist. When people show images of what they call chemtrails, they are invariably looking at normal contrails. Not understanding the science behind contrails, they say the ones that last a long time are deliberate spraying. But it's just the weather.

The distinction here seems simple. Contrails are real; chemtrails are not. But the conspiracy theory has been around so long and has been spread in so many ways that ordinary people (such as Garcia) who are not particularly conspiratorial will often refer to contrails as chemtrails. I've even heard skeptics do this.

It is *very important* to point this out when it happens. I usually say something such as, "Those are just contrails. Chemtrails are not really a thing," and then let them respond to that. If we normalize the use of *chemtrails* for *contrails*, then it's going to add another layer of complexity to our attempts to explain things.

Weather Modification

Weather modification sounds bad, conjuring up images of mad scientists (or evil cabals) steering hurricanes, depriving some regions of water, flooding other regions, and blocking out the sun.

In reality, weather modification primarily consists of a process called "cloud seeding"—spraying something into clouds to make them rain more. Far from being secret, it has been openly performed since the 1950s. Cloud seeding in the United States can be done from the ground or from planes.

Cloud seeding from planes does indeed involve spraying chemicals, specifically silver iodide. When discussing it in the context of "chemtrails," the most important thing to remember is that *it does not leave trails*. Cloud seeding does not create clouds; instead, it makes clouds rain by freezing and growing the water droplets so they fall as snow (and then rain, depending on the ambient temperature).

Weather modification cloud seeding is done by small planes over existing clouds and has a brief effect. It does not leave trails. [AI]

Geoengineering

Geoengineering is a broad term covering many different methods of attempting to change the climate, usually as a way of combatting global warming. This is done by modifying how much of the Sun's energy stays on the planet by blocking or reflecting sunlight or by encouraging more heat to be radiated at night.

Currently, most geoengineering projects involve carbon reduction. Because global warming and climate change is caused by increased levels of carbon dioxide in the atmosphere, the simplest way to address this is by reducing those levels. The first method is to simply reduce emissions. The next (and the one that's arguably "geoengineering") is to remove the carbon dioxide that is in the air.

Importantly, carbon dioxide removal (CDR) geoengineering techniques *do not involve spraying things into the air*. In fact, it's the opposite; CDR geoengineering *removes* chemicals from the air.

The type of geoengineering that does involve spraying things in the air is solar radiation management (SRM). This idea is inspired both by nature and human activity. It has been observed that volcanic eruptions that loft a lot of material into the upper atmosphere will block sunlight and slightly cool the planet. The same effect is observed with industrial pollution.

SRM attempts to duplicate this by deliberately spraying or releasing material or gases into the stratosphere. The most important thing for skeptics to know about SRM is that nobody is actually doing it in any meaningful way. SRM via spraying is almost entirely a theoretical science. Some experiments have been proposed, but almost nothing has been done.

One company, Make Sunsets, has released a small amount of material into the air, but this is more of a provocative artistic statement than anything mean-

Geoengineering does not leave trails. It attempts to cool the entire planet over a timescale of years. [AI]

ingful. The material amounted to a few kilograms and was perhaps a billionth of the amount of pollution that is released annually by industrial processes around the world.

The second most important thing about SRM geoengineering is that, like weather modification, it *does not leave trails*—at least not trails that look like contrails. According to geoengineering researchers, anything sprayed from a plane for SRM would be invisible or look like hazy smoke.

Weather Modification vs. Climate Geoengineering

Weather modification is not geoengineering. The intent of geoengineering is to affect the climate of the entire planet. Climate is the long-term average of weather patterns over a large region over several years. Weather is the short-term conditions in a particular spot measured at a particular time or over a brief period.

For example, the *climate* of California features dry summers and wet winters. The *weather* in Sacramento today (as I look out my window) is wind and rain. Weather modification, being very local, might make it rain a little more in Sacramento (or, more realistically, in a small region of the nearby Sierra Mountains) on the day they do cloud seeding. It won't affect the climate of California or the world, so it's not geoengineering. Geoengineering might make the California summers, on average, a little cooler and the winters, on average, a little less wet. It's not weather modification.

What's the Harm?

Ostensibly, these bills are driven by a desire to protect public health and the environment. They list atmospheric "contaminants." Kentucky seeks to address "criminal atmospheric pollution." But if that were the case, why are there not similar bills banning *industrial pollution*—something that is much more impactful than the miniscule amounts of cloud seeding done every year. Why seek to ban geoengineering, something that's yet to get more than a few pounds of material—the same material that industry has been spewing for decades—into the atmosphere?

It seems that the bills are motivated by something more than the public good. To varying degrees, they seem to be reactions to a belief in the chemtrail conspiracy theory. They really don't make sense any other way. Chemtrails are just misidentified contrails. But conspiracists think that the contrails they see daily are chemtrails. They think (because they have been told by conspiracy outlets) that those chemtrails are a form of secret geoengineering. They also think that weather modification is geoengineering. So, they ban everything: geoengineering, weather modification, and sometimes any form of spraying things into the air.

This has real consequences. Weather modification (cloud seeding) has been practiced for eighty years with no significant negative health effects—mostly because of the incredibly low concentrations of the chemicals used by the time they reach the ground. A focus on the supposed spooky spraying of chemicals from planes distracts from very real pollution issues.

Cloud seeding appears to work. Clouds that are seeded produce more rain. It's not much, it's a bit variable, and the science is still evolving, but it can make a difference to local agriculture. A blanket ban on cloud seeding because of fears founded in the chemtrail theory is not helping anyone. Augustus Doricko, the CEO of cloud seeding company Rainmaker, said: "If weather modification is banned [in Florida], it sets a precedent to deprive farmers in even more arid regions of the country from getting access to water from cloud seeding" (Doriko 2025).

Geoengineering, in the sense of solar radiation management, is not something that we (humanity) have yet done in any meaningful sense. But with an uncertain future climate, it might be the only option to deal with the problems stemming from unrestricted CO_2 emissions. A blanket ban on this will not stop any current spraying, because there is none. However, it will greatly hinder the ability to conduct research. We need to research geoengineering to understand what the challenges and impacts are so we can make more informed decisions in the future.

Bans also place an increased regulatory burden on aviation-related industries. Should airports now be forced to check if every single plane that uses the airport is part of some nefarious spraying plot? These excessive and unwarranted laws are particularly odd coming from Republican legislatures, which are more typically focused on reducing government regulations and environmental oversight. Unfortunately, the lure of conspiracy theories has once again defeated science and reason. ■

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[THE TIME WARP: SKEPTICISM REVISITED—FROM THE FUTURE

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Full Moon, Full Wards? How Science Craters That Lunar Link

Welcome aboard, friends! In The Time Warp, we aren't limited to present-day examinations. We use Skeptical Inquirer's rich history to examine skepticism … from the future. On this voyage, we travel to Summer 1979 and volume 3, number 4 of Skeptical Inquirer.

Some historical debris to prepare us for the journey: SONY introduced the Walkman (July 1); disco was in; Donna Summer's *Bad Girls* reigned five consecutive weeks at #1 (July 7–August 4); Skylab fell to Earth (July 11); Jimmy Carter gave his "Crisis of Confidence" speech (July 15); *The Amityville Horror*—which arguably became the most famous haunting story in the United States—was released in theaters (July 27).

And Skeptical Inquirer was there, helping people get out of paranormal rabbit holes.

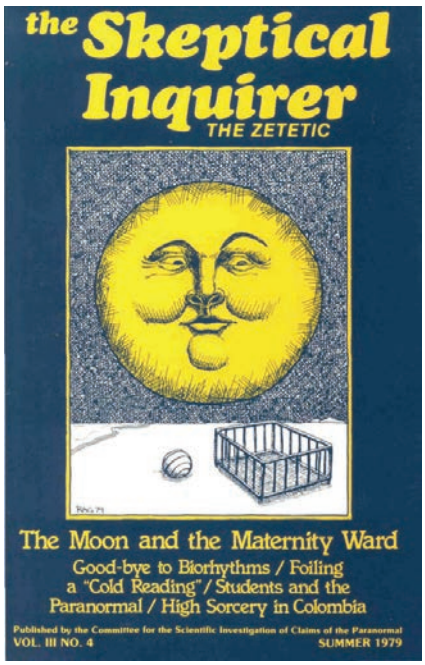
Some Skeptical Thoughts from the Time

Terence Hines reviewed the problems with biorhythms, a discredited theory that all humans have physical, emotional, and intellectual performance cycles that begin at birth.

James Randi dissected the unimpressive cold reading that self-proclaimed psychic Geraldine Smith provided on Canadian television.

Elmer Kral, a high school English teacher, shared how he developed critical thinking in the classroom.

John Sack, in an excerpt from a forthcoming book, described his 1975 interaction with the "World's Greatest Sorcerer" in the Colombian Andes. The sorcerer said his girlfriend traveled to the East (and then back to the West). Sack subsequently learned that his girlfriend had been napping in her geostationary home.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THE ZETETIC
The Moon and the Maternity Ward
Good-bye to Biorhythms / Foiling a "Cold Reading" / Students and the Paranormal / High Sorcery in Colombia
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VOL. III NO. 4
SUMMER 1979

Deep Dive: Moon and Maternity Ward

George O. Abell and Bennett Greenspan examined a classic folk claim in their article "The Moon and the Maternity Ward." The issue's cover was similarly devoted to the Moon and birthrate theme. Abell and Greenspan began broadly, describing the Moon's importance in human history. The light provided by the full moon enhanced morning and evening farming as well as other nighttime activities. The Moon creates tides and, occasionally, even eclipses the Sun. In this context, it is not surprising that so much folklore gravitates toward our Moon.

Abell and Greenspan then turned to the specific belief that women have more babies when the Moon is full. Existing examinations into lunar phase and birthrate provided inconsistent results. Abell and Greenspan thought another examination was warranted, particularly given the enormous implications of any truly mystical influence coming from the Moon.

They reviewed nearly 12,000 birth-related hospital records spanning from March 17, 1974, to April 30, 1978. The obtained results showed no systematic relationship between lunar phase and the frequency of live births, uninduced live births, multiple births (e.g., twinning), or stillbirths.

Abell and Greenspan observed, "These results were a considerable surprise to several of the nurses at the UCLA Hospital maternity ward: for they, like so many others, fully expected to find a strong correlation of birthrate with full moon" (p. 24). They also speculated that nurses were prone to remember the times when both the Moon and the maternity ward were full, and this nudged the nurses to see a correlation in a sea of randomness.

Abell and Greenspan mentioned they had also reported their analysis in *The New England Journal of Medicine*. Despite their findings being published in that publication as well as SI, belief in the influence of the full moon on birthing continued, as did research examining lunar phase and births—an outcome that won't surprise many skeptics. Belief in the influence of the full moon on birthing continued, as did research examining lunar phase and births.

Looking back from 2025, the results provided by many systematic studies are consistent with lunar phase having no correlation with birthrate. Most studies find no effect. A study occasionally detects a heightened birthrate at some point in the lunar cycle, but those findings aren't consistent. Thus, results that might look suggestive in isolation don't really demonstrate anything other than that a

small number of false positive findings can occur when researchers conduct many statistical tests.

A 2024 study continued this theme. Ambrogio Londero and colleagues examined 13,349 pregnancies at a single hospital across 6,939 days. Their analysis detected potentially legitimate meteorological influences: human births are slightly more probable when both the Sun and Moon were above the horizon, presumably due to changes in barometric pressure. But they found "no correlation between birth and moon phase" (Londero et al. 2024, 1).

Londero and colleagues did not reference Abell and Greenspan's research or the skeptical summary of that research that appeared in the Summer 1979 Skeptical Inquirer. Maybe Londero and colleagues will cite this Time Warp analysis if they publish more Moon and birthrate research in the future.

Post-Trip Summary

Belief in the power of the full moon over human births, despite several statistical examinations that discredit the claim, illuminates where critical thinking sometimes wanes.

First, people can mistakenly see correlations between variables—such as lunar phase and birthrate—that do not actually exist. This occurs because observations that seem to confirm the belief carry more psychological weight than observations that disconfirm the belief, a process consistent with confirmation bias.

Second, people are too willing to believe claims that, if true, would confound physicists worldwide. For many, the Moon-birthrate claim is based on a belief that celestial bodies exert some undetected spiritual influence on human affairs. It's tough to prove that something *doesn't* exist, but it seems unlikely that the next major discovery in physics will come from a New Age spiritualist working at a strip mall.

Third, sensational claims are appealing, and they are more likely to be shared as folklore than mundane claims about everyday events. The appeal of sensational claims causes people to promote those claims without checking them.

Unfortunately, there are just so many nonsensical claims that skeptics and others can't stay ahead of them. Consequently, the full moon's baby popping magic remains a thing, along with innumerable other "amazing" claims that could be discredited with some fact checking.

Skeptics need to keep trying despite these challenges. The fabulous thing about skeptics is that they typically work at the face-to-face level where people can be gently, and genuinely, turned from unreasonable claims—claims that can be harmful or even fatal.

In summary: You matter, skeptics! The articles and videos by themselves only do so much. So please keep cultivating your own skepticism. Keep being there to question outlandish claims, whether they involve haunted Amityville colonials or moonlit maternity wards. ■

Note

The views expressed belong to the authors and do not necessarily reflect the official policy or position of Northshore School District.

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[INSIDE IMMUNITY ANDREA LOVE

Andrea Love, PhD, is an immunologist and microbiologist with over a decade of experience. She is a subject-matter expert in infectious disease immunology, cancer immunology, and autoimmunity and is adept at translating complex scientific data and topics for the public and healthcare providers. Love is the author of *Immunologic*, a newsletter and science information hub, and is the executive director of the American Lyme Disease Foundation.

Same Science, Different Reactions: Genetic Engineering in Medicine and Food

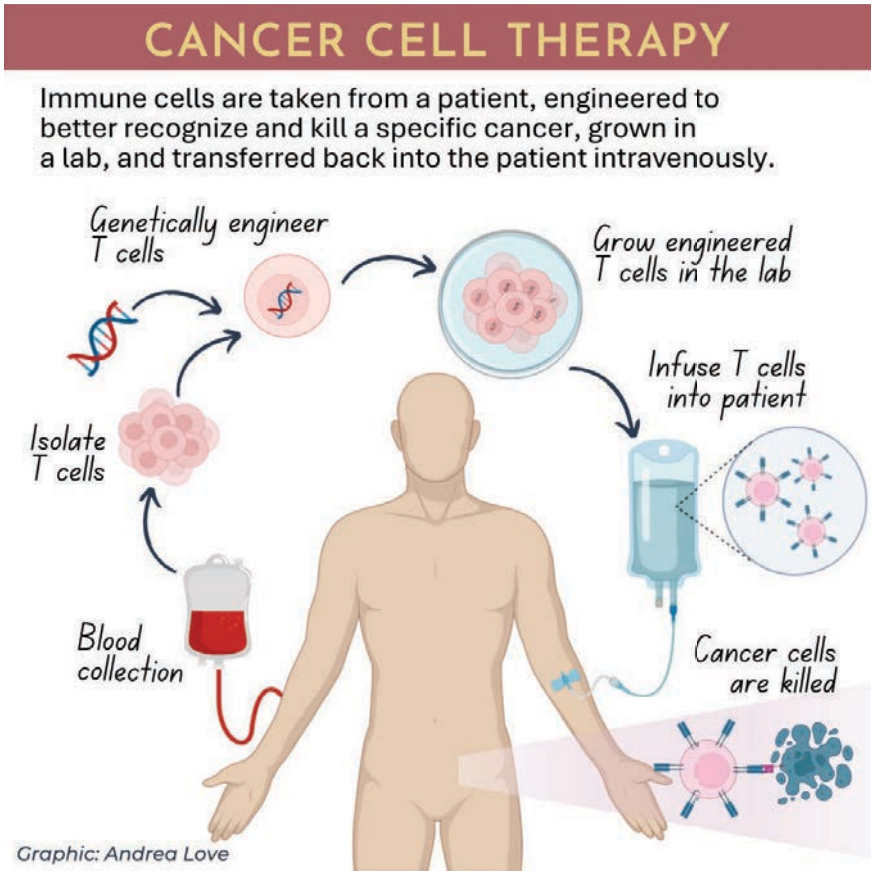
As a biomedical scientist working in cancer and infectious disease immunology, I've spent decades working with genetic tools and genetic engineering. These technologies have revolutionized human health and have given us treatments for diseases previously untreatable.

Less than ten years ago, these therapies were not available at all; today we have around forty different gene therapy–based treatments for diseases, including cancer, sickle cell disease, Duchenne muscular dystrophy, and more.

The first FDA-approved gene therapy is used to treat B-cell acute lymphoblastic leukemia (B-ALL). Specifically, it is a type of CAR T cell (chimeric antigen receptor) therapy, approved in 2017 (Maude et al. 2018). CAR T cells are the patient's own immune cells that are genetically engineered to better recognize a specific protein (antigen) displayed on those cancer cells, allowing T cells to target and destroy the cancer (Maude et al. 2018).

This added gene leads to the production of a new receptor protein with characteristics of the normal T cell receptor (TCR) and the new features that enable CAR T cells to directly bind cancer antigens, hence the name. Chimera, in Greek mythology, was a creature with the body of a lion, the head of a goat, and the tail of a serpent. Here, the chimera is the T cell receptor.

To create CAR T cells, we isolate T cells from the patient's own blood. In the lab, we modify the T cell genes so the T cells will now produce the CAR protein. That's the genetic engineering part. We grow those engineered T cells up in the lab and infuse them back into the patient, where they can seek and destroy those cancer cells.


CANCER CELL THERAPY
Immune cells are taken from a patient, engineered to better recognize and kill a specific cancer, grown in a lab, and transferred back into the patient intravenously.
Genetically engineer T cells
Grow engineered T cells in the lab
Infuse T cells into patient
Isolate T cells
Blood collection
Cancer cells are killed
Graphic: Andrea Love

The scientific principle and technology behind CAR T cells are based around editing the DNA (the genes) of immune cells to give them new and beneficial functions. The goal? Create innovative medicines to treat diseases, improve health, and save lives.

But guess what? This same genetic engineering approach isn't limited to medicine.

In fact, the very same scientific tools are critical in agriculture. At the heart of agricultural and biomedical genetic engineering is recombinant DNA technology, a tool used to alter genetic material to achieve beneficial outcomes.

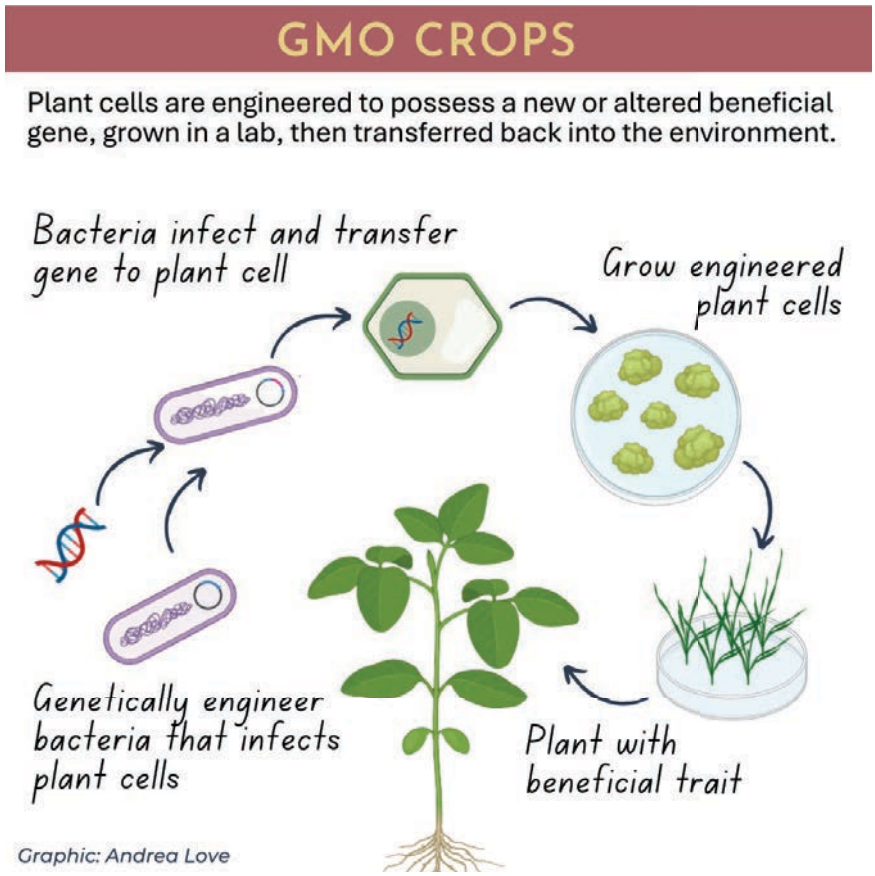
In agriculture, it gives crop plants beneficial traits: improved nutrition, pest resistance without the need for

external pesticides, drought tolerance, and more. These beneficial traits improve food production and food stability through what you know as genetically modified organisms (GMOs), the first food crop of which was FDA-approved in 1994. (Technically, *genetically engineered* is more accurate, because everything is *genetically modified*.) Yet I guarantee that you can find someone who praises the virtues of novel cancer treatments while only buying foods with the "non-GMO" label.

In farming, just as in medicine, genetic engineering is conferring a benefit. It is marrying the best of nature and science to improve our lives. Golden rice, developed in the 1990s, is rice that was genetically engineered to produce beta-carotene, a precursor of vitamin A (Ye et al. 2000). When we consume beta-carotene, our bodies convert it into vitamin A, an essential micronutrient.

Rice is a staple crop in low-income countries, but it lacks vitamin A. Vitamin A deficiency (VAD) is prevalent in these regions and has serious health outcomes, including blindness, hearing loss, corneal scarring, increased mortality from diarrheal and other infectious diseases, and death (World Health Organization 2009; Song et al. 2023). VAD impacts over sixty-two million children and causes between 125,000 and 250,000 pediatric deaths every year (Song et al. 2023; WHO 2009; Stevens et al. 2015).

Golden rice was developed to solve this problem and save lives. It is genetically engineered rice where two added genes enable rice to produce beta-carotene that is as readily usable by our bodies as other sources (Ye et al. 2000). To do this, scientists harness a bacterium, *Agrobacterium tumefaciens*, which naturally infects and transfers its DNA to plant cells. This process was adapted to transfer those new genes into rice plant cells. Those plant cells are cultured in the lab into calli, then plantlings, which then mature into plants that produce beta-carotene in the rice grain in eight to twelve months (Beyer et al. 2002). This rice has the same growth requirements as regular rice and provides essential vitamin A, helping combat malnutrition and its severe consequences (Tang et al. 2009).


GMO CROPS
Plant cells are engineered to possess a new or altered beneficial gene, grown in a lab, then transferred back into the environment.
Bacteria infect and transfer gene to plant cell
Grow engineered plant cells
Genetically engineer bacteria that infects plant cells
Plant with beneficial trait
Graphic: Andrea Love

It is estimated that up to 2.5 million lives could be saved every year by increasing intake of vitamin A through dietary sources or supplementation. In India alone, it is estimated that Golden Rice could prevent more than 40,000 pediatric deaths if it were approved and grown in place of regular rice (Stein et al. 2008).

Unfortunately, anti-biotech rhetoric has delayed the approval of Golden Rice in countries that desperately need it—even though extensive laboratory and field-based studies spanning over twenty years have demonstrated that Golden Rice (and other genetically engineered crops) are safe, nutritious, and beneficial. Yet misinformed public outcry has led to pushback and delayed review and approval of countless genetically engineered crop plants.

In 2021, the Philippines approved Golden Rice for cultivation, the only country to do so thus far. But because of false claims and legal challenges by activist groups such as Greenpeace, the Supreme Court of the Philippines banned growing Golden Rice in 2023 before it could make a difference. This ban is based on opinion, not scientific evidence, yet it is halting scientific progress and harming public health. Delayed approval of Golden Rice because of unfounded opposition to genetic tools is estimated to cost 1.4 million life years annually in India alone (Wesseler and Zilberman 2014; Wesseler and Zilberman 2017).

It is estimated that up to 2.5 million lives could be saved every year by increasing intake of vitamin A through dietary sources or supplementation.

Ironically, people who readily accept

medical treatments made through genetic engineering, such as human insulin (the first FDA-approved GMO product in 1982, made by genetically engineered bacteria) often reject genetically engineered food crops, convinced they are harmful.

The reality? The science is the same. The regulatory standards and frameworks are extensive and rigorous in both sectors. Both use precise and intentional changes in specific DNA segments to add or improve something.

That's true whether it is human insulin, cancer cell therapy, gene therapy for sickle cell disease, rice with added nutrition, papaya resistant to a deadly virus, or eggplant that produces insecticide, eliminating the need to treat crop fields with external insecticides.

What are the common threads of these developments that use genetic engineering? Improved public health. Improved food supply stability and quality. Reduced ecological impact of farming. Additional medical interventions for debilitating and deadly diseases.

And yet misinformation spreads because of low science literacy and intentional disinformation. Anti-biotechnology activism has restricted the development and implementation of these innovations. It's led to legal challenges and prohibitions based on vibes, not science.

The consequences of misinformation about GMOs extend well beyond grocery store choices. False claims about genetic engineering delay life-saving agricultural innovations that can address urgent global problems such as malnutrition, vitamin deficiencies, climate change, and food insecurity. Golden Rice approval has been delayed for decades by unfounded fears, despite decades of scientific evidence that supports the immense benefit it offers.

Misinformation about genetic medicines reduces people's trust in life-saving medical treatments such as vaccines, cancer therapies, and more. Right now, legislation is being pushed to ban all medicines based on genetic tools in states across the United States, even while that would apply to things such as human insulin (Love 2025). Rejection of these scientific developments increases costs, slows scientific progress, and reduces access to measures that improve our health and the planet.

Tackling misinformation isn't just about being accurate—it's about preventing cultural beliefs, ideology, and unfounded claims from undermining scientific progress, no matter the field. So why do some people celebrate genetic engineering in hospitals but ban it on farms?

We cannot afford this inconsistency. If we trust genetic engineering to save a child from leukemia, why do we reject it when it could save a child from blindness, malnutrition, or death? The science is the same. The benefits are proven. The data are robust and rigorous. It's time to apply the same evidence-based standards to agriculture and medicine—and reject misinformation that harms people that is based on misguided fear. Scientific progress saves lives, whether in a hospital bed or a rice paddy. We should embrace it everywhere it helps humanity. The stakes are too high to let ideology overrule science. Lives depend on it, now more than ever. ■

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[SKEPTICAL INQUIREE BENJAMIN RADFORD

Benjamin Radford is a research fellow at the Committee for Skeptical Inquiry and author or coauthor of fourteen books, including *America the Fearful: Media and the Marketing of National Panics*.

EVP, AI, and Proof of Ghosts

Q: **Years ago, you told me that the only ghostly evidence you might consider valid was a dead famous person speaking about something that happened after their death (for example, JFK talking about the September 11, 2001, attacks). With AI advancements, has your stance changed at all?**

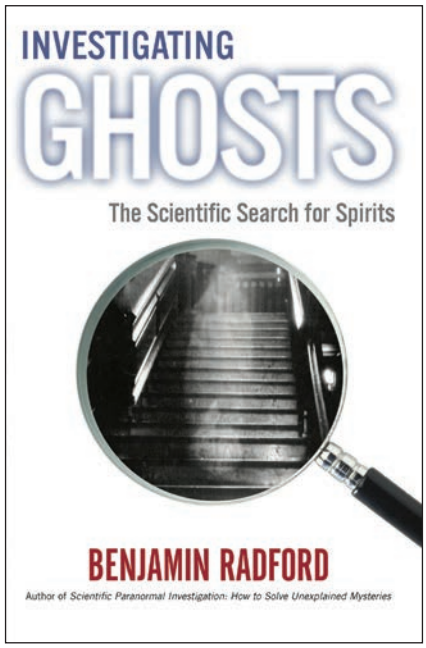
—Julia B.

A: Julia is a longtime local ghost hunter friend of mine who runs tours in the historic Old Town area of Albuquerque, not far from the famously (and formerly) haunted KiMo theater (see Radford 2014). Her recollection isn't quite accurate, though. The example I offered was specific to electronic voice phenomenon, or EVP. She was referring to a talk I gave, but the same example appears in my *Investigating Ghosts* book:

> One way that EVP might someday prove the existence of ghosts is through voice analysis. For example, let's say that a ghost hunting group investigated the White House and returned with an EVP of President John F. Kennedy speaking about something that happened after his death. Because there are plenty of Kennedy's speeches for comparison, researchers could do a voiceprint analysis of the EVP to verify that it is Kennedy's voice. Of course, to rule out hoaxing (it could be just a sample from one of his recorded speeches), the content of the message would have to refer to something that he could not have recorded while living (alarm over Donald Trump's presidency for example). This would be very, very strong scientific evidence of ghosts. (Radford 2017)

So it's not that such evidence is the *only proof* I'd accept but instead that it would be *very strong evidence* for the existence of ghosts, and I stand by that.

The question of AI does raise interesting issues; certainly the technology is (or soon will be) good enough to realistically recreate any dead person's speech, assuming there's enough source material. While the cadence and intonation may be a bit off and hint at its generated nature, that would be easily dismissed by ghost hunters with *ad hoc* arguments: "*Of course* it's not going to sound *exactly* like the dead person; they're disembodied spirits! Communicating across the barrier separating our worlds surely changes their voice"—eliding the inescapable fact that physical teeth, tongues, and lips are required to create voice sound waves in the first place.



Nevertheless, the issue of context remains: Under what conditions are people hearing these novel phrases and anachronistic information in the voices of verifiably dead people? Are groups of people hearing a disembodied voice from above them out in the open, say during a séance in a Gettysburg meadow, or in an empty room that can be searched for the presence of speakers? Or is this being heard only coming from a device operated by a specific ghost hunter in a decrepit mansion that could have any number of hidden places for a hoaxed transmission?

In fact, given the very low quality of EVP—virtually all of its "meaning" is sonically tortured out of muffled and ambiguous sounds—the irony is that an AI-generated phrase would likely be implausible. As writer Joe Banks (2012) notes in the book *Rorschach Audio*:

> One paradox of EVP is that if the voices recorded were of similar quality to normal high-fidelity studio recordings of speech, then nobody would believe them for a minute. If someone came to you claiming that they possessed a recording dictated after death by one of your own close relatives, and they then played a high-quality recording of a stranger speaking in a normal voice, it's reasonable to assume that most people would be not so much convinced but instead quite deeply insulted; and it is a strange fact that it is because of, rather than despite, the very low sound quality of most EVP recordings that at least some listeners are seduced into suspending disbelief. A better production would, ironically, be *less* convincing.

Here we see a sort of Goldilocks twilight zone of ambiguity: The EVP cannot be too faint or it won't be noticed, but it also mustn't be too loud or it won't be believable. They must sound enough like fragments of human speech—whether AI-generated or otherwise—but not be too clear. They must give enough ambiguous, potentially plausible "information" (such as first names, words, or phrases) to be taken seriously but not too much information (such as "my name is Tom Harding; I died in 1847 after being hit by a carriage near the corner of Washington and Second streets"). It's the same with Bigfoot photos and drone videos: too clear and we know what it is but too blurry and we don't notice.

The primary task would be ruling out other plausible alternative explanations for the observed phenomenon. A secondary, and far less important question, is of categorization: What type of phenomenon are we looking at? We don't know for certain what ghosts are—or, more accurately, what unique and distinctive experiences make up a ghostly encounter—so we can't really know for sure that apparent ghostly activity is not really an invisible gremlin, telekinesis, or some other unknown, unfalsifiable force. This ambiguity lies at the heart of many murky mysteries: When small objects are said to move or cupboards shut and open on their own, is it due to poltergeists, fairies, psychic powers, or none of the above? In the classic case of Gef the Talking Mongoose, possible explanations ranged from a ghost, a hoax, a psychic, a poltergeist, or a talking animal (see Radford et al. 2023).

However, following Ray Hyman's reminder to first be sure to establish the presence of a phenomenon before attempting to classify it, that is putting the cart before the unicorn. Whether we suspect an EVP is AI-generated or not doesn't matter if we can account for it using ordinary explanations. If, for example, a desk or books suddenly begin verifiably floating in the air and both an illusion and hoaxing can be ruled out, then that's pretty convincing evidence of some paranormal event—whether it's ghosts, psychic powers, or mischievous

Original: Kevin Escate | Unsplash

tiny angels isn't really relevant. But that doesn't happen; every report of some event that—if true—would clearly violate natural laws turns out upon close investigation to be rooted in legend, misperception, uncorroborated anecdote, and so on.

Alleged evidence of ghosts is very broad, including moving dowsing rods, a feeling of being watched, beeping devices, orbs, EVP, to name a few examples. Part of the issue is that there's no consensus on what ghostly phenomena cover, or even what indicates the presence or absence of ghosts (shadow figures, sensed-but-unseen presences, semi-transparent figures, or even ordinary-looking people who are glimpsed suddenly disappearing through walls). In their book *Ghostly Encounters: The Hauntings of Everyday Life*, Dennis and Michele Waskul examine how people experience ghosts in everyday life. They found:

> [Many people] were not sure that they had encountered a ghost and remained uncertain that such phenomena were even possible, simply because they did not *see* something that approximated the conventional *image* of a "ghost." Instead, many of our respondents were simply convinced that they had experienced *something* uncanny—something inexplicable, extraordinary, mysterious, or eerie. (Waskul and Waskul 2016)

So, we see why verifying ghostly phenomenon is problematic—even for non-skeptics. Many people who will go on record as having a ghostly *experience* didn't necessarily see anything that most people would recognize as a classic "ghost," and in fact may have had completely different experiences whose only common factor is that they could not be readily explained. This is of course both a gross violation of Occam's razor and an example of the argument from ignorance fallacy ("I don't know what this is, therefore it's a ghost").

It is true that hard evidence for ghosts has never been found. Why is conclusive proof so elusive? There are only two possible explanations for this. The first is that these phenomena do not exist, and all the evidence for them are the result of hoaxes, honest mistakes, misidentifications, and misperceptions. This doesn't mean that the search should end, just that the reason for the lack of good evidence must be dealt with. The second possibility is that ghosts are real and do exist but that the efforts to confirm their existence have so far failed because the search is being conducted in the wrong way and researchers are not verifying their assumptions and asking the right questions. I'm open to good evidence of ghosts, but so far it has not … materialized. ■

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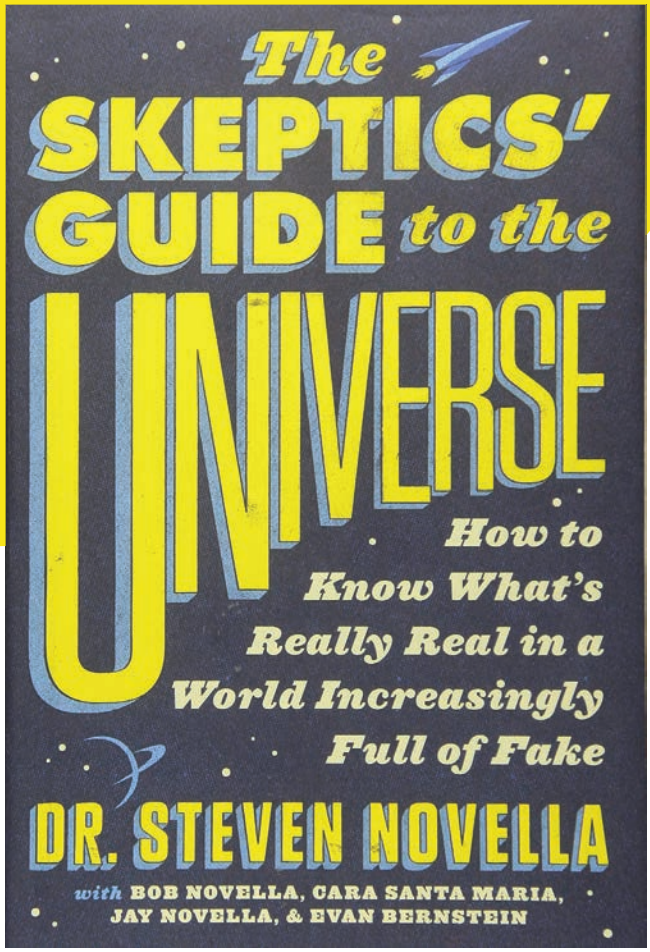
After Decades of Skepticism, How Are We Doing?

STEVEN NOVELLA


The
SKEPTICS'
GUIDE to the
UNIVERSE
How to Know What's Really Real in a World Increasingly Full of Fake
DR. STEVEN NOVELLA
with BOB NOVELLA, CARA SANTA MARIA, JAY NOVELLA, & EVAN BERNSTEIN

I still remember (at least in the aggregate) when I first started reading Skeptical Inquirer. It was a revelation—careful analysis by people with expertise on a range of scientific topics, especially those not often covered (and certainly not covered well) by the mainstream media or even science outlets. I also remember when Perry DeAngelis, my close friend and soon-to-be partner in crime, picked up the latest issue of SI from my coffee table, flipped to the back, and showed me the listing of local skeptical groups.

"Look, there's no group in Connecticut. That's us," he said, pointing at the two of us. That small observation sparked thirty years of skeptical activism, including the podcast that SI and its editor, Stephen Hupp, are kind enough to let us celebrate in its pages.

The Skeptics' Guide to the Universe (*SGU*) recently celebrated its 1,000th episode and completed its twentieth year of continuous skeptical podcasting. I won't feign false humility. I am proud of the work my team and I have done and the tireless dedication it required. I am also proud of the work the entire skeptical community has done.

This includes those giants on whose shoulders we stand and the many friends and colleagues I have been lucky enough to meet along the way. We have our quirks and disagreements, no doubt, but in general I have found a group of people who care about the world, who care about truth and enlightenment, who bristle at fraud and deception, and who don't just complain but actually try to do something about it. I would not want to belong to any other community.

I also think we have earned ourselves a bit of a victory dance. This is not so much to gloat or pat ourselves on the back but to seriously look back at the past few decades of skeptical activism and ask the question: How are we doing? We are, after all, dedicated to science and scientific methods, and this is part of the self-correcting aspect of any scientific or serious intellectual endeavor. Specifically, when it comes to the many big issues that skepticism has focused on over the past twenty years of the *SGU*, or thirty years of my personal activism, or almost fifty years of the modern skeptical movement (beginning with the formation of CSICOP, now CSI), have we been mostly correct or not?

I think we have been almost entirely correct. At least in the broadest sense, we have been on the correct side of science pretty consistently (especially once there is enough time to work out any internal disagreements). To be fair, this is partly because we pick a lot of low-hanging fruit. Whether or not Bigfoot ex-

Skepticism, which includes not only scientific literacy, but critical thinking skills and media savvy, has evolved into a sophisticated skill set—arguably the most important skill set there is—in a world simultaneously flooded with complex science and information along with misinformation, disinformation, and outright fraud.

ists, we are being visited by aliens, astrology works, or homeopathy is anything but magic water is not, scientifically speaking, a tough call. Our job there is not to make difficult decisions but to understand why so many people are attracted to and believe things that are clearly not true. We also defend the role of science and philosophy in our society and whack down the moles of pseudoscience whenever they pop up. And studying rank pseudoscience actually is a great way to understand real science and to recognize bad methods and reasoning in their more subtle forms, which degrade even the most legitimate of sciences.

As the skeptical movement has matured, we have targeted more and more complex questions. We have also chronicled and put into practice the evolving science of understanding conspiracy thinking, misinformation, the roles of memory and perception, analytical versus intuitive thinking, science denialism, and related topics. Skepticism, which includes not only scientific literacy but critical thinking skills and media savvy, has evolved into a sophisticated skill set—arguably the most important skill set there is—in a world simultaneously flooded with complex science and information along with misinformation, disinformation, and outright fraud.

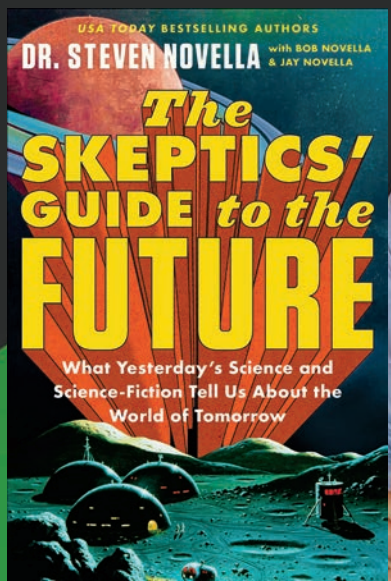
In practice, what kind of track record does this skill set have? Pretty damn good, even if you move past the low-hanging fruit. Do vaccines or any vaccine ingredients cause autism? Nope. Are GMOs causing massive public toxicity? Doesn't look like it. Is the alternative medicine "revolution" going to start spitting out safe and effective natural cures? I wouldn't bet on it. Cars that run on water? Zero-point energy? Alien autopsy? Three strikes. Evolutionary theory continues to thrive, while intelligent design has predictably faded into intellectual obscurity.

A thorough treatment of even a small sampling of the many issues we have covered over the decades is beyond the scope of this special issue, or even any issue of the SI, so in the pages to follow we are each going to take a broad look into just a few select topics, all of which we covered in the 1,000th *SGU* episode. ■

Steven Novella, MD, recently retired from his position as an academic neurologist at Yale University School of Medicine. He is a cohost of *The Skeptics' Guide to the Universe* podcast, the author of the *Neurologica* blog, and a contributor to the *Science-Based Medicine* blog. He is also a fellow of the Committee for Skeptical Inquiry.

The Skeptics' Guide to the Future

To watch Steven Novella's talk from *Skeptical Inquirer Presents*, scan the code or visit skepticalinquirer.org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UFOs, the Media, and Our Culture: Everywhere and Nowhere

A look into twenty years of news reporting on UFOs reveals little change over time.

EVAN BERNSTEIN

In 2005, they were unidentified flying objects (UFOs). Twenty years later, they are now more accurately referred to as the all-encompassing unidentified anomalous phenomena (UAP).

The Skeptics' Guide to the Universe (*SGU*) podcast debuted in 2005. Like in all grassroot efforts in skeptical activism, UFOs were considered standard fare. Today, UAP continues to be a regularly visited topic for commentary on how modern culture and our media blissfully operate under the false assumption that Earth has been visited by intelligent life from outer space.

Fortunately, cultures are not solely defined by any one of their aspects. The scientific method, skeptical inquiry, and critical thinking still have influence over a great many things. In 2005, the scientific understanding of UFOs was almost exclusively skeptical, with most scientists and researchers attributing UFO sightings to conventional explanations. UFO enthusiasts and true believers were kept at bay, operating on the fringes of actual scientific inquiry, and they were relegated mostly to bad (yet ironically popular) television programs.

If you read a sample of news articles about UFOs from 2005, you may find many were simply reporting the latest and greatest evidence, consisting mostly of videos captured with fairly unsophisticated, and relatively affordable, camcorders.

Remember, there were no iPhones in 2005.

Prior to 2005, the body of evidence supporting claims that our planet was being visited by extraterrestrials amounted to zero. There was no physical evidence to inspect, no otherworldly technology to understand, and no advanced-alien organic material to decipher.

What did exist, in overwhelming abundance, were stories, anecdotes, retellings, secondhand accounts, thirdhand accounts, and arguments from authorities of all kinds. There were blurry photographs—a lot of them. Some were inevitably blurrier than others, and the blurrier the evidence, the more "convincing" to UFO proponents. There were also garbled audio recordings and outright fakes of a "home movie" quality on both film and video. And for sixty years prior to the start of the *SGU* podcast, that was the sum of the evidence upon which the entire modern UFO belief system was built.

The latter twentieth century's appetite for otherworldly beings seemed insatiable. A small taste for UFOs eventually captured the imaginations of a generation of people from the 1940s, 1950s, and 1960s. By the 1970s, the damage had been done, and the wheels were set in motion. Even the great skeptical communicators of the time, including Carl Sagan and Phillip Klass, could not slow the momentum. Government-backed science-based efforts, such as Project Blue Book and The Condon Report, could not change the minds of enough people to stop the surge.

Where there are people so fond of an idea, there will be other people looking to capitalize, taking advantage of these all-too human feelings and beliefs. *Cui Bono?* Who benefits?

Media's nature, how it survives, must look for ways to sell enough of their product to satisfy their sponsors. When there is a population with a craving for something that can be packaged as both remotely plausible and remotely fantastic, it becomes an elegant formula to help improve sales. It also provides additional avenues of access to the public for characters and those on the fringe looking for a way into the discourse. *The Art Bell Show* is the classic twentieth-century example of this; his pro-UFO radio show has been one of the most successful in history. Today, some of the top podcasts in the world rely on this very old, yet reliable, formula to help draw their massive audiences. The bottom line is that UFO news coverage tends to help the bottom line.

While recording our 1,000th episode of the *SGU* podcast, I decided to try and take a twenty-year measure of the media's reporting of UFO and UAP news articles. I was genuinely curious as to how the media have adapted to the reporting of UFO stories since 2005. Is it better, worse, or the same? Are there any trends to discover?

With the assistance of large-language-model general artificial intelligence (namely, ChatGPT), I came up with my (admittedly) unscientific approach to an otherwise complicated attempt to measure, or spot a trend, about the types of UFO and UAP reports covered by accredited media outlets. Patently tabloid media sources were excluded from the results.

I asked ChatGPT the following question, exactly the same, for every year starting in 2005 through 2024: What were the top UFO news articles from the year 20XX? I devised five categories and assigned each article to its best-suited category. The categories were: Public Sightings, Government, Pop Culture, UFO Proponents, and Scientific and/or Skeptical. In all, there were 135 articles, and Table 1 depicts the percentages for each category.

Table 1: Percentage of UFO/UAP News Articles in Each Category

Category	Percentage
Public Sightings	40%
Government	36%
UFO Proponents	12%
Pop Culture	8%
Scientific/Skeptical	4%

Only one out of every twenty-five articles took a mostly scientific or skeptical approach. This was very disappointing and, unfortunately, very much expected. There is too little data to measure a trend, but it would seem that good articles on UFOs and UAP are as scant today as they were in 2005.

Perhaps the one category that has shown a shift is government. In the mid-2010s, the articles relaying government investigations, politicians making statements, and agency press releases began to rise in frequency. From 2005–2014, 18 percent (eleven out of sixty-two) of the articles were government-themed, and this rose to 52 percent (thirty-eight out of seventy-three articles) in the next ten years. It would be impossible to peg the exact reasons for this, but it has been an interesting shift as UFOs and UAP become more a part of our political landscape and discourse. There is a saying that politics lies downstream from culture. Perhaps that is true in this case.

So what was I able to discern from my investigation? What are the differences between 2005 and 2025 when it comes to UFO and UAP reporting? I learned that what was true twenty years ago is still true today. Then UFOs and now UAP continue to be both everywhere and nowhere at the same time. ■

Evan Bernstein is cohost of *The Skeptics' Guide to the Universe* and the *Which Game First* podcasts. He is coauthor of the book *The Skeptics' Guide to the Universe: How to Know What's Really Real in a World Increasingly Full of Fake*.

Twenty Years of Health Scams and Wellness Trends

From Miracle Mineral Solution to anti-vaccine claims, quack medicine continues to pose a persistent danger to society.

CARA SANTA MARIA

Looking back on the past twenty years of snake oil and quackery is a monumental task. My first recording as a full-time rogue on *The Skeptics' Guide to the Universe* (*SGU*) podcast aired on July 25, 2015 (episode #524). The *SGU* had already been debunking pseudoscience in folks' earholes for a full decade at that point. I was still in graduate school when the podcast was formed, and I'd never even heard of skeptical activism. Yet I was honing my skills in baloney detection even then while working in a neuroscience laboratory and already questioning outlandish biomedical claims, beauty bullshit, and wellness scams.

Quack Medicine

The first thing that came to mind when looking back on the past two decades of medical malarkey was a recent discussion about Miracle Mineral Solution (MMS). We talk about MMS a lot on the show. But as a quick reminder, it's bleach. That's all. The miracle is bleach. The mineral? Also bleach. It's a bleach solution that's only miraculous in that it hasn't killed *more* people in the past. This industrial bleach solution has been marketed as a cure for everything from HIV to cancer to autism. But it doesn't cure HIV or cancer or autism. Do you know what happens when you drink large quantities of bleach? You get really sick. Some people die. This is why MMS comes up so often on the *SGU*—it is really dangerous. There are documented deaths from this so-called alternative medicine.

I decided to go through the entire archive of the *SGU* and do a deep dive on MMS. It was first mentioned on the show on December 29, 2010. Then again in 2014 and 2016. In 2019, the Food and Drug Administration (FDA) warned against it. A man who ran a church and sold MMS as a religious cure was indicted in 2021 and convicted two years later. In 2024, another MMS peddler went to prison, this time in New Zealand. That's actual movement—real change when it comes to this particular brand of pseudoscience. So I thought, "Ooh, I'll do this for every major medical scam! What a great idea!" Then I thought, "Wait—I have a full-time job. I'm not going to do that."

Instead, I had the black box that is ChatGPT come to my overworked rescue. I first went way back into the human archives, looking for some of the earliest forms of medical pseudoscience. In the fifth century BCE, there was humoral theory (black bile, yellow bile, blood, and phlegm). Bloodletting followed and persisted all the way up until the nineteenth century, long after we knew it was not a valid form of medical intervention. Bloodletting is often touted as one of the original medical scams, but its use began during a time of limited medical knowledge.

LittleT889 | Wikipedia

In the modern era, I would argue that charlatanism was synonymous with patent medicine. When we use the term *snake oil*, this is what we are talking about. In the nineteenth and early twentieth centuries, minimal regulation and maximal marketing led to a boom in the sales of all sorts of unsupported "cures," such as literal oil of snake and other herbal or mineral

elixirs, potions, and liniments. Even though patent medicine use slowed drastically after the passing of the Pure Food and Drug Act in 1906 (and later revisions of the statute), hucksters will huckster in any way they can. Recapitulations on the nostrum theme moved along with the changing zeitgeist and persist to this day. It doesn't help that beginning during the Reagan era, relatively robust protections were systematically rolled back. This finally culminated in the Dietary Supplement Health and Education Act of 1994, a law that prevents the FDA from regulating dietary supplements before they go to market (which they do for drugs). The result is a free-for-all for the vitamin industry and a bunch of ineffective or downright dangerous modern snake oil lining the shelves of pharmacies, grocers, and big box stores across America.

Phrenology and radium cures may be out of vogue, but other quack remedies are still going strong. There's a cyclical nature to medical pseudoscience, and we see alternative treatments coming in and out of fashion over and over again. Gerson therapy comes to mind—a magical blend of diet, supplements, and coffee enemas that is meant to cure cancer (spoiler alert: it doesn't).

In fact, I was curious how many times we mentioned, for example, homeopathy and chiropractic on the show over our first 1,000 episodes. I promise I tried to find out, but my queries broke the transcript archive search engines. I can't give you a number. It's a lot though. Too many, really. Detoxes. Diet cleanses. Weird practices touted as "medical spas." New quack treatments try to keep pace with biomedical advances, using buzz words that make them sound legitimate to the credulous consumer.

Perhaps one of the most persistent forms of medical pseudoscience covered across the *SGU*'s time on air is the anti-vax movement. Truth be told, as early as there were vaccines, there were vaccine deniers. Andrew Wakefield sent the movement into hyperdrive when he published fraudulent data in both 1998 and 2002, erroneously claiming that the measles, mumps, and rubella (MMR) vaccine causes autism. Even though both studies were retracted by the publisher, you can't un-ring a bell. So when the COVID-19 pandemic swept the globe, there was a massive resurgence of that rhetoric. And it wasn't just an anti-vax movement. All sorts of alternative treatments were touted, from ivermectin to hydroxychloroquine to, well, injecting disinfectant or shining UV light inside the body.

And the malarkey continues. ChatGPT reminded me about subluxation theory, essential oils, alkaline water, colon cleanses, cryotherapy, cupping, vaginal steaming, and so much more. Researching this topic proved to be a beautiful example of one of my favorite show topics—the tendency for human beings to categorize things and put them into boxes. We just love taxonomy and attempts to construct hard-and-fast rules for classification. But how do I even begin to organize medical myths? There are homunculus-type myths and cleansing-type myths and blame-and-shame-women-type myths, but some examples cross into different categories, leaving the list feeling inordinately long and fuzzy.

Take vaginal steaming, a great example of the way the wellness industry really preys on women. And it does so in a sly, under-the-radar way that masquerades as empowerment. There's a pernicious narrative that from the time you are a young girl, you need to make sure you aren't too dirty or smelly or sick or unbalanced or oily or shiny or "wow, look at those clogged pores." The narrative continues with promises such as, "if you buy my product, I can promise a clean, virginal, youthful appearance." No need to be a human being when you can be a porcelain doll. And as you age, it just gets worse and worse with increasingly weird medical spa menu items such as laser lipo, reiki, ozone therapy, and vampire facials (search online—it's super gross, and it also led to a devastating HIV outbreak in New Mexico).

What's the Harm?

One important question we often ask on the show is, "What's the harm?" When it comes to the whole of medical scams, there are so many different ways to approach that question. When I asked ChatGPT to shed light on the topic, I struggled with the verbiage used in my prompts. *Most unhealthy? Most pernicious? Most dangerous*? How do you even define that? Is it the number of deaths that are directly attributable to a particular pseudoscientific practice? What about the number of people who die delaying treatment because they choose the alternative route first? Or maybe the externalized costs—the money that people desperately spend on an exorbitantly pricey Hail Mary? What about the legitimization of certain industries—even those that we think of as maybe not necessarily being harmful but more neutral. The beauty industry is a perfect example. Whether it is the original source or simply a mechanism of perpetuation, the blame and shame that women carry due to this multibillion-dollar industry is impossible to quantify.

A little less nebulous are cases of actual, verifiable deaths directly attributed to alternative medicine. Now, I'm not *that kind* of doctor and I cannot give medical advice. But I feel pretty safe in recommending that we all stay away from the following:

- Chelation therapy for autism is documented to cause kidney damage, cardiac arrest, and death.
- Gerson therapy for cancer is known to hasten death due to delaying or forgoing evidence-based treatment.
- Colonic hydrotherapy (colon cleansing) has led to perforated intestines, septic shock, and death.
- Drinking raw milk has led to dangerous bacterial infection, Guillain Barré syndrome, hemolytic uremic syndrome, and death.
- Black salve, a corrosive paste that's claimed to draw out cancer from the skin, causes disfigurement, tissue necrosis, and, again, hastened death from delayed cancer treatment.

Wellness Trends and Health Scams

Ultimately, I asked ChatGPT to go back to the first year *SGU* was on air (2005) and tell me the top trending wellness fads and medical scams each year for the past twenty years. I have no idea what criteria the software used in gathering this information, so if you find something different, take it up with our AI overlords. For example, 1,000 episodes ago, in 2005,

Table 1: Top Trending Wellness Fads and Medical Scams by Year as Indicated by ChatGPT

Year	Wellness Fad	Medical Scam
2005	juice cleanses	colonics
2006	pilates	magnetic therapy
2007	superfoods (such as açai bowls)	ear candling
2008	yoga	homeopathy
2009	CrossFit	ionized water
2010	veganism	anti-vaccine movements
2011	gluten-free diets	human chorionic gonadotropin drops and injections (marketed for weight loss)
2012	meditation	raspberry ketones
2013	green smoothies	miracle mineral supplements (i.e., bleach)
2014	paleo diet	green coffee bean extract
2015	fitness trackers	waist trainers
2016	bulletproof coffee	alkaline diets
2017	cryotherapy	essential oil cures
2018	CBD oil	stem cell therapy scams
2019	intermittent fasting	blood type diet
2020	home workouts	COVID-19 miracle cures
2021	immune boosting supplements	anti-5G radiation devices
2022	mental health apps	NAD+ supplements
2023	hormone balancing diets	ozone therapy
2024	tech-driven wellness (such as AI personalized wellness plans)	frequency healing devices

juice cleanses and colonics took the lead. In the next year, pilates was hot. That's fine with me, to be honest, I dig pilates. We can keep it. But so was magnetic therapy. In 2007, it was superfoods (such as açai bowls) and ear candling. Really? That recently, people were all about the ear candling? Yikes. Check out Table 1 to see what ChatGPT indicated for all twenty years for the top trending wellness fads and medical scams. Keep in mind that a few of the wellness fads do have potential benefits (such as home workouts), but all the medical scams are problematic.

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Health pseudoscience is rank on the internet, and it's safe to say that nothing is really new. Most of the herbal supplements popular today were first marketed in the 1800s. And sadly, many were (often incorrectly) co-opted from indigenous practices. That grinds my gears more than almost anything I've mentioned thus far. Peddlers of quackery frequently engage in a twisted form of cultural appropriation wherein they claim their snake oil dates back millennia, from a people who used it in sacred cultural rituals. But often the "treatment" in question is relatively new and packaged for the Western consumer. This ends up harming not only the folks being marketed to but also the very people who are claimed to be its originators. ■

Note

This article was adapted from my segment in the 1,000th episode of *The Skeptics' Guide to the Universe* podcast, recorded on August 18, 2024.

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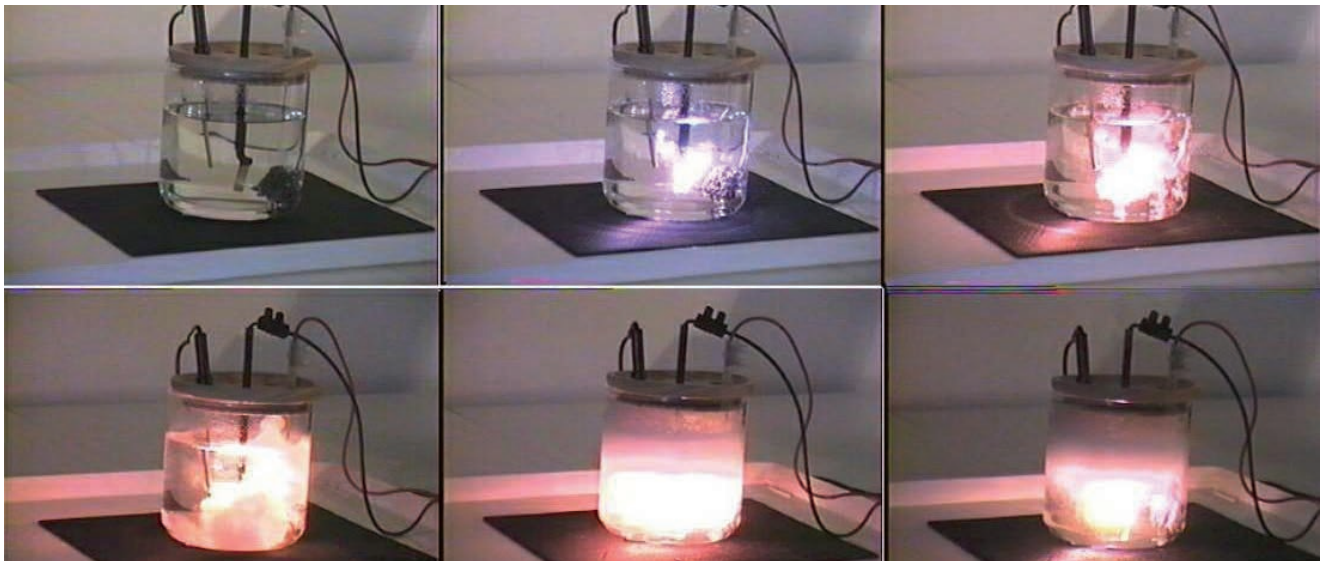
A Look Back at Cold Fusion

Pons and Fleischmann's cold fusion became a textbook case of pathological science—implausibility, flimsy evidence, and no reproducibility.

ROBERT NOVELLA



Juan-Louis Naudin, 2003

Has it really been over thirty-five years since the cold fusion hubbub? It's hard to believe more than a generation has passed. One of the things we've learned on *The Skeptics' Guide to the Universe* podcast over our many years of sci-com (science communication) and skepti-com (did I just coin that?) is that many settled scientific and skeptical controversies come back to life as new generations discover them. It can be quite frustrating to deal with recycled pseudoscience that you thought was dead and buried years ago but has somehow clawed its way back like some kind of annoying zombie, using long debunked arguments that are just repackaged for a new generation. They're immune to the lessons of history and always ravenous for fresh brains—to infect.

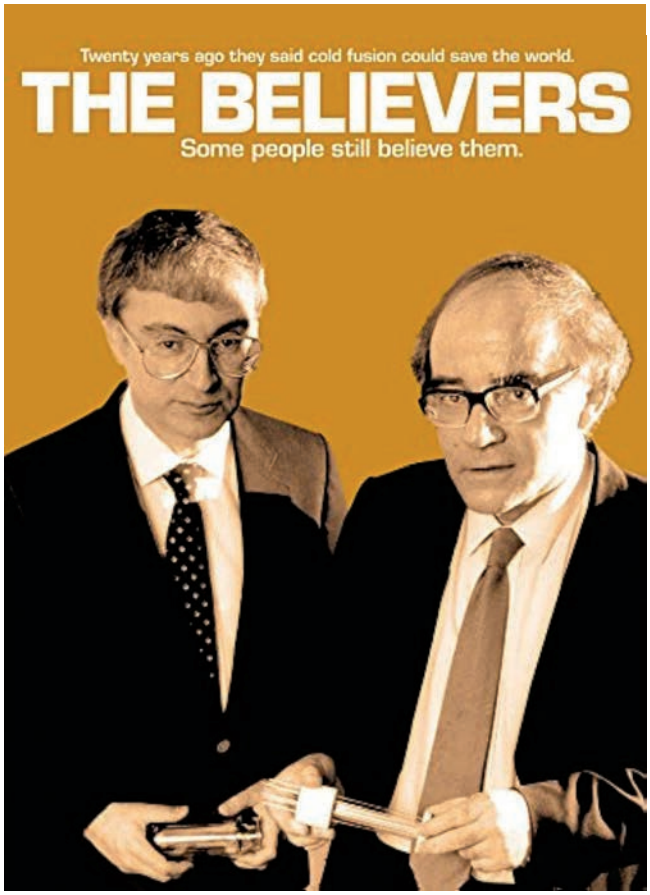
Didn't you listen to our podcast from fifteen years ago, where we debunked the crap out of that pseudoscience? And we weren't the only ones; a plethora of other skeptical podcasters and writers did too. We've kind of resigned ourselves to the fact that this is one of the important functions of science and, especially, skeptical communities; we're repositories of institutional knowledge, keepers of the flame if you will, ready to pounce on old pseudoscience when a new generation seems poised to embrace it yet again.

Cold fusion research never really went away, unfortunately. It went into the shadows and rebranded itself as low energy nuclear reactions (LENR). Some of the research is legitimate, but many still want to vindicate the electrochemists Stanley Pons and Martin Fleischmann. It may never come back with the furor of, say, flat-earthism or vaccine denial, but it will always be a symbol of pathological science. Going over these events could help skeptical neophytes as well as the OGs. As I often do in the podcast, I will also try to add interesting and genuine scientific details that exist in and around the bad science.

Pons and Fleischmann Experiments

I'm sure we all remember the broad brushstrokes of the cold fusion fiasco, which started way back in 1989. Pons and Fleischmann performed what they thought were groundbreaking experiments with palladium and heavy hydrogen (Fleischmann and Pons 1989). The "fusion cell" they created was said to produce 100 times the heat that would be expected by simple chemical reactions (Mallove 1991). In addition, they claimed nuclear byproducts such as neutrons were detected, which are even stronger indicators of fusion. They interpreted all this as evidence of an unknown nuclear process that could allow for an inexpensive and clean way to harness fusion for energy production.

It's hard to imagine all the ways this would change the world. It would remake and revolutionize energy production,



Documentary released in 2012 featuring Stanley Pons (left) and Martin Fleischmann (right).

space travel, medicine, computing, industry, the global economy, and even more.

After a brief paper was published, a press conference was held in March 1989 where Fleischmann announced, "What we have done is to open the door of a new research area … Our indications are that the discovery will be relatively easy to make into a usable technology for generating heat and power" (Fleischmann and Pons 1989).

The reaction to the announcement of nuclear fusion at room temperature was nothing less than explosive for scientists as well as the public. It was at this point that the media dubbed this technology *cold fusion*. Many scientists were skeptical, however, even if they were also very curious.

Labs and companies worldwide attempted to replicate the experiment, but the results were, to put it bluntly, a disaster. Many labs failed outright to detect any evidence of fusion. Those that claimed extra heat or neutrons did so at barely detectable levels, or they soon withdrew their initial claims of success due to experimental error. Some notable quotes from that time include: "Scientific schlock" and "Maybe fraud" by Ronald Parker, a nuclear scientist at MIT (Platt 1998). And Nathan Lewis, leader of the California Institute of Technology cold fusion investigation team, said, "It is a simple chemical reaction that has nothing to do with fusion" (Browne 1989).

The turning point happened in May 1989 when 1,500 scientists in the American Physical Society got together to discuss replication problems. Caltech theoretical physicist Steven E. Koonin famously said, "We are suffering from the incompetence and delusion of Pons and Fleischmann" (Browne 1989). After this meeting, cold fusion was completely discredited for most mainstream scientists.

The final two blows happened later in the year. First, Pons and Fleischmann were unable to produce convincing evidence when pressed. Then in November 1989 the Department of Energy reviewed the claims and concluded that there was no credible scientific basis to support cold fusion and would no longer fund it (Greco 2021).

Pons and Fleischmann then withdrew from the mainstream of science, eventually moving to France to continue their cold fusion research.

The Coulomb Barrier

It's helpful at this point and interesting to consider the real fusion science that made many scientists so skeptical right out of the gate about cold fusion. It was because all known pathways to fusion must overcome the infamous Coulomb barrier, the energy threshold needed to surpass the electrostatic repulsion between like charges, such as protons. This electric repulsion, caused by their positive charges, is far stronger than anything you felt as a kid pushing the poles of two magnets together. Unlike that magnetic push you remember, the Coulomb barrier is a pure electric force, millions of times stronger at nuclear scales.

It's easy for our Sun to overcome this force. Just gather a couple million zeta-tons of hydrogen, and let gravitational confinement do its work. We can't do that on Earth, so we have to use other confinement methods to give protons enough energy to deal with the pesky Coulomb barrier. We have had some success with magnetic confinement (such as tokamak devices) and especially inertial confinement using a hydrogen bomb or perhaps 192 powerful lasers to implode a fuel pellet (at the National Ignition Facility).

Remarkably, even the hottest stellar cores are far too cold to allow a sufficient number of protons to get all the way over the Coulomb barrier. Luckily, quantum mechanics literally saves the universe here. The protons still need to be extremely energetic, but they only need to get past enough of the electrostatic repulsion to make quantum tunneling much more likely to happen. Once a significant number (but small percentage) of protons "tunnel" through the rest of the barrier, the strong force can then reel them in and initiate the fusion that makes the stars shine as they do.

This is why many scientists and skeptics in 1989 quickly dismissed the claims. Even though palladium can absorb tremendous amounts of heavy hydrogen and pack it together very densely, there was no theoretical framework or good evidence to support the possibility of these cold atoms sustaining meaningful fusion reactions. Sure, having an open mind is often required for breakthroughs to happen, but when you posit entirely new nuclear reactions that would rewrite funda-

mental physics, then scientific rigor and enhanced skepticism at all stages of experimentation and analysis becomes even more paramount.

As the days and months passed, that necessary scientific rigor was shown to be essentially nonexistent; it was more like the rigor mortis of pathological science than anything else. Their failures went far beyond what you may remember. I was shocked when I dove deep into this research.

Extraordinary Claims

The classic dictum that extraordinary claims require extraordinary evidence was clearly obliterated here. Their evidence of excess heat was later shown to be riddled with problems. In fact, their fusion heat claims were much more likely to be simple misinterpretations of chemical heat, plus measurement errors and variables they did not control for.

Far more problematic was their evidence for known fusion byproducts. Not only were their measurements inconsistent and incomplete, but they often went against the known physics of fusion reactions. This is also another example of pseudoscience—ignoring known theoretical constraints. The absence of expected neutrons, gamma, and other signatures was an absolute deal breaker for many scientists.

This leads to other hallmarks of bad science, the resistance to outside expertise. Pons and Fleischmann, as two electrochemists, were clearly out of their depth when it came to nuclear physics. A partnership with an expert in that field (which they refused) could have shown conclusively that theory combined with proper measurements prove that fusion was not happening in the palladium.

There are so many more factors, but I'll list just two more: overconfidence and premature publicity. These often go hand in hand with pathological science, and in this case it was a death grip. Pons and Fleischmann made a rushed public announcement; they dramatically shortened peer review, and they abandoned additional experimental validation that could have continued for over a year. I remember many criticisms of this referring to it as "science by press release."

I wasn't aware at the time, but some of this behavior appears to be related to the University of Utah and the researchers wanting to secure patent rights and funding before anyone else could (see University of Utah 1989). Many think this impacted not only the release of adequate testing details but also their willingness to collaborate on many levels. If true, this would explain much of what happened. The prioritization of financial and institutional concerns and this "patent first, prove later" approach to scientific discovery and understanding is distasteful in the extreme. Imagine if all scientific research were carried out this way.

Hard Truths versus False Hopes

To cleanse the palate, let's end with an example of cold fusion that is not only real but also a triumph of rigorous science: muon-catalyzed fusion (MCF)—a phenomenon distinct from the electrochemical "PseudoFusion" of Pons and Fleischmann.

Muons are the corpulent cousins of electrons, weighing in at over 207 times their mass. Replacing hydrogen electrons with muons results in muonic hydrogen with atoms that are much smaller and closer together. This is because the heavy muons create orbitals that are vastly smaller than electron orbitals. With atomic volumes now nine million times more compact (207 cubed), the atomic nuclei are also 207 times closer together than they would be under normal conditions. As you might imagine, this proximity means that the probability of nuclear reactions such as quantum tunneling is vastly increased. You know where this is going, right? The bottom line here is that fusion rates are increased so dramatically (100 million times) that fusion can occur at much lower temperatures, even far below room temperature. This is true cold fusion.

What I have just described is a real phenomenon that has passed peer review, been verified experimentally, and is grounded in long-established principles of nuclear physics. This real cold fusion was theoretically predicted as far back as the 1940s and was confirmed by experiment by Luis Alvarez in 1956 (Alvarez et al. 1957).

So why aren't we driving our Mr. Muon Fusion cars? The reason for that is also rooted in theoretical science and confirmed by many replicated science experiments. Muons typically last for only millionths of a second and are too expensive to create to make this worthwhile. Muons also tend to get "sticky" and can't cause as many fusion events as they otherwise would in their brief lives. Decades of research have unfortunately offered no hope of getting around these problems.

But that's okay. Good science is its own reward. I'd rather have the hard fascinating truths from real science than the false hopes from poor experiments based on theoretical nonsense. ■

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A Brief History of Climate Denialism

It took the skeptical community some time to collectively acknowledge global warming, but that's exactly how science and skepticism should work.

STEVEN NOVELLA

The denial of anthropogenic global warming—that human industrial activity is forcing the Earth's climate on average to become slowly warmer over time—has been one of the most significant and important issues the skeptical movement has tackled. The skeptical approach to this issue has been to understand the consensus of expert scientific opinion, the evidentiary basis for that opinion, the confidence levels, and the uncertainty.

The topic also requires an understanding of the methods of science denialism, the political and cultural forces behind that denialism, and the tactics used by climate change deniers to sow doubt and confusion on the issue. Tackling this topic has been a great skeptical learning experience, and its lessons apply to many areas.

This is also a great topic to look back on because both sides of the debate made some fairly specific and conflicting falsifiable predictions. Broadly, climate change deniers have variably claimed that climate change is not happening at all, or, that if it is happening, it's simply part of the natural cycle. The climate should therefore not only stop warming but "regress to the mean."

Climate scientists, on the other hand, argued that all known or proposed natural cycles have been ruled out, that forcing by greenhouse gases is the only viable explanation for the increase in temperatures observed, and therefore we should expect (and in fact have modeled in detail) continued warming over the coming decades.

These are pretty divergent predictions with a pretty clear outcome: The past ten years have been the warmest decade on record, with 2024 being the warmest year ever recorded. (World Meteorological Organization 2025). This is *exactly* what climate scientists predicted and completely undercuts the position of climate change deniers. They can try to rewrite history and move the goalposts, but I lived through the past thirty years of debate on this issue. They cannot run from the documented record.

But let's get into some more detail.

The fossil fuel industry knew about the potential for global warming since the 1950s, and by 1980, the science was becoming pretty clear. This prompted a highly funded and deliberate campaign of denial and doubt. As Geoffrey Supran and Naomi Oreskes (2021) reported in *The Guardian*: "In 1991, Informed Citizens for the Environment, a front group of coal and utility companies announced that 'Doomsday is cancelled' and asked, 'Who told you the earth was warming … Chicken Little?' They complained about 'weak' evidence, 'non-existent' proof, inaccurate climate models and asserted that the physics was 'open to debate.'"

According to legal discovery yielded during multiple lawsuits, ExxonMobil and other companies had a deliberate campaign to portray climate science as "unsettled" and climate change as just a theory (Supran and Oreskes 2017). These are talking points still heard today.

In the early 2000s, deniers were claiming that global warming had stopped or "paused." The implication was that it was never real, just a natural fluctuation. They supported this claim by cherry picking the starting point of the "pause"—an unusually warm El Niño year. This is a clever way of cherry-picking data (kind of like the optional starting and stopping of ESP research).

But there was also a real statistical phenomenon going on. Statistical significance builds up with more data, and for this reason climate trends tend to work on decadal time frames. So any recent trends are not likely to be statistically significant (yet), which you can falsely use to argue that warming has "paused." This phenomenon was exacerbated by the El Niño anomaly. In the end, the "pause" was always just an artifact (Sumner 2015). But this became a prominent denialist talking point for twenty years.

In 2017, climate contrarian Richard Lindzen wrote a letter to President Donald Trump accompanied by a petition, claiming that carbon dioxide is not a pollutant and in fact is good for crops (Ekwurzel 2017). CO_2 was ruled a pollutant by the U.S. Supreme Court, and it is clear that rising temperatures will cause more harm to crop yields than the effects of CO_2.

Throughout the past two decades, it became increasingly apparent that there is a strong consensus of actual climate scientists that anthropogenic global warming is happening. This became the famous "97%" figure (Skeptical Science 2024). The number is now even higher, whether you consider climate scientists or the climate literature (Lynas et al. 2021). Deniers denied this figure, denied that there is a consensus, and then denied that there is even such a thing as consensus in science.

The same story plays out when you look at the effects of global warming. Worldwide ice is decreasing, and glaciers are disappearing (NASA n.d.). Sea levels are rising (National Oceanic and Atmospheric Administration n.d.). Hurricanes are becoming more powerful, and we are seeing an increase in droughts and wildfires.

So climate change deniers denied that climate change is

happening at all, then they denied that it was anthropogenic, and then they denied that it would cause harm. Now they are claiming there is nothing we can do about it. Along the way, they claimed there was no consensus and that warming had paused. None of their claims have stood the test of time. They are left whining about being called "deniers" and are still trying to claim the mantle of "skeptic." Sorry. They can't have it.

Meanwhile, we can go back to 1988 when James Hansen testified before Congress, showing the projected warming under current climate models and making various assumptions about future policy (Nuccitelli 2018). He pretty much nailed it, projecting an increase of 0.6–0.7°C by 2017. Actual warming increased by 0.6°C.

These climate models also just keep getting better as they are progressively tweaked. Overall climate models have done a very good job at predicting actual warming despite the lies of deniers about this fact (National Academies n.d.).

To be fair, in the early 2000s the skeptical community was still wrapping its collective head around the global warming issue. It's scientifically complicated with many moving parts. We came a bit late to this issue, after a denialist campaign was well under way. Listening back to our own discussions on the topic in the early days of *The Skeptics' Guide to the Universe* podcast, I do wince a bit. I did say from the beginning that I think anthropogenic global warming is real science and that the critics are using a lot of denialist tactics.

But compared to my current position, I was also naive about those critics, such as Lindzen and others, falsely assuming they were acting in good faith. I was also insufficiently aware of the degree to which fossil fuel industry deliberate propaganda was driving the controversy. It took time to fully appreciate the dedicated denialism at work. But before long, the full picture became quite clear.

The skeptical community was critical for this learning process. This is our true strength. No one can know everything about everything. But we as a community span many different types of expertise and have various perspectives. Collectively we are a powerful intellectual force, as long as we communicate with each other respectfully and in good faith.

My time in the skeptical community has been an amazing journey, one I will continue for the rest of my life. It has been the best learning experience I could imagine. We should cringe a bit when we look at our younger selves; it reflects how much we have grown and learned. At the same time, it's amazing how much we have gotten right. In my opinion, that's because scientific skepticism is a process—a process that works. It's also a process that needs continued nurturing and protection. ■

WORLD METEOROLOGICAL ORGANIZATION
WMO confirms 2024 as warmest year on record at about 1.55°C above pre-industrial level
PRESS RELEASE
10 January 2025
The World Meteorological Organization (WMO) has confirmed that 2024 is the warmest year on record, based on six international datasets. The past ten years have all been in the Top Ten, in an extraordinary streak of record-breaking temperatures.

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Steven Novella, MD, recently retired from his position as an academic neurologist at Yale University School of Medicine. He is a cohost of *The Skeptics' Guide to the Universe* podcast, the author of the *Neurologica* blog, and a contributor to the *Science-Based Medicine* blog. He is also a fellow of the Committee for Skeptical Inquiry. Author photo by Susan Gerbic.

The Force behind *The Skeptics' Guide to the Universe*

JAY NOVELLA

My brother Steve Novella is the creator, producer, and host of *The Skeptics' Guide to the Universe* (*SGU*). I was with him every step of the way for this incredible journey and want to share what I experienced.

Steve was the first person I ever heard question pseudoscience. In the bubble of my 1970s childhood, Steve was the very first rational voice in my life. Back when Steve, Bob (my other brother), and I were kids, pseudoscience was largely unchecked. We believed in everything from UFOs to ESP to voodoo. It all was provocative and fun to believe in, and for a long time there was zero questioning of anything. I remember us watching with our father the TV show *In Search Of* hosted by Leonard Nimoy. It covered mysteries and anomalies, such as Bigfoot, the Bermuda Triangle, and ESP. The show was credulous. There was zero skepticism and zero production quality, but we loved it. *In Search Of* planted the seeds of disinformation in the generations of people who watched it, including us.

In the early 1980s, Steve, Bob, and I were teenagers, although I'm four years younger. The *Star Wars* original trilogy was in mid-swing, and the Police's last album was in full rotation. Along with the fun of those times, Steve was struggling with the realization that some of our family's long-held beliefs had worn thin. This included our religion and a laundry list of pseudoscientific nonsense. Steve had a series of epiphanies that became the pillars of his journey into critical thinking. I remember him talking about his shift in perspective. By the time he started telling Bob and me, he had already fully realized religion was hollow in its logic. His skepticism was starting to spread to more topics, and as he learned Bob and I learned from him.

The modern skeptical movement started in the late 1970s with the founding of the Committee for the Scientific Investigation of Claims of the Paranormal (CSICOP) by Paul Kurtz, James Randi, Carl Sagan, Ray Hyman, and others. Steve got his hands on the early small-format edition of the precursor to the Skeptical Inquirer called *The Zetetic* (renamed in 1977 under the editorship of Kendrick Frazier). This publication played a pivotal role in the modern skeptical movement and significantly influenced all of us.

We were always interested in science, but Steve helped shift our interests from *liking* science to *understanding* it. Steve also introduced us to Carl Sagan's TV series *Cosmos: A Personal Voyage*. That show came at the exact right time, and we enthusiastically digested all of it. We learned that scientific skepticism was the only perspective that made sense.

From left to right: Jay Novella, Robert Novella, and Steven Novella circa 1970s.

In Steve's college years, he refined his understanding of both science and critical thinking, all the while sharing everything with Bob and me. I didn't know it at the time, but he was shaping Bob and me into padawan skeptics. We started to be that guy in the room. You know, the guy who starts sentences with "Well, actually …"

In 1992—the year that *Reservoir Dogs* and *Army of Darkness* came out—Steve, Bob, and I met Perry DeAngelis and Evan Bernstein for the first time. Perry and Evan knew each other since 1986 as gaming friends. We, of course, had no idea what the future held and that the five of us would one day form a skeptical Voltron. We had a lot in common. We all loved to role play both traditional games such as Dungeons & Dragons and live-action role playing. We all were science

enthusiasts and existed in the cross section between nerds and geeks. And we all had a skeptical perspective on reality.

In the winter of 1996, Steve's very first formal skeptical activism began with a newsletter titled the *Connecticut Skeptic*. This was under the umbrella of the Connecticut Skeptical Society. Steve, Bob, Perry, Evan, and I were the first members. To this day, Bob still has his membership card.

In 1995 and 1996, Steve, Bob, Perry, and Evan formally created The New England Skeptical Society (NESS). Over the next ten years, Steve led us all into an intellectual adventure. There were recurring NESS-sponsored talks with about ten to twenty people in attendance. We met James Randi and John Renny. I remember going with the guys on a live in-person recording of a morning radio show that had ghost hunters. They were part of an organization run by the local infamous married couple Ed and Lorraine Warren, the famous ghost-loving couple from Connecticut who made a living giving talks about how ghosts, demons, and possession were real. They had a museum in their basement filled with ghost-related items that were taken from their investigations. To this day, we don't know for sure if they really believed in ghosts.

In one of the encounters with the Warrens, Steve asked them for their best evidence that the supernatural exists. Ed Warren loaned Steve a VHS tape they recorded on one of their ghost investigations. Ed claimed that one of his ghost hunters disappeared on video; he was there one second and gone the next. Evan worked for an audio/visual company that had high-end video editing decks. The deck could show the full recording on the tape that included the border of the image that's not visible on a consumer version of the machine. What they found was that a hand came into the outer edge of the frame and turned the camera off and then on again. This explained the disappearing person. When Steve confronted Ed with this information, Ed angrily said, "All I know is that kid disappeared!" No, Ed, he didn't.

During those NESS years, Steve was always thinking about how to reach people and how to get people interested in critical thinking. He was influenced by Carl Sagan and his book *The Demon Haunted World*. We all read it enthusiastically more than a few times. Steve chose to not mix critical thinking with atheism, humanism, or politics. He realized that his brand of outreach wasn't contentious; it was simply rational. He applied his skepticism unilaterally. In my opinion, this has proven to be an effective approach.

In the late 1990s, Steve went on a popular daytime talk show called *The Ricki Lake Show*. In his episode, the topic was vampires. The actual title of the show was "I Hate That You Sleep in Coffins and Hang Out in Cemeteries … Quit Being a Vampire!" A guest on the show, who called herself Dust, claimed she was a psychic vampire. Instead of blood, she claimed to be able to drain people's minds. Perry, who had been sitting in the audience, stood up and said, "I offer myself. Would you drain me, please?" No mind-draining happened that afternoon.

In 2005, during a weekly online video game session, one of our friends introduced us to a largely unknown thing called podcasting (this predates Apples iTunes' podcasting category). Once Steve heard about it, he knew immediately that podcasting was the venue he was looking for. He sent us all an email, asking us if we wanted to quit the game and shift that time to making a skeptical podcast. He quickly convinced all of us to do it. Thinking back, that was a hard sell going from a great video game to what then seemed like a lot of work. He did it though, and within days Steve emailed us the original format of the show. Looking back at that email, Steve conceptualized the show almost exactly as it is today. He nailed it from day one. We all sent show name ideas, and one of Perry's was by far the best. Because we are all fans of Douglas Adams, *The Skeptics' Guide to the Universe* jumped from the screen. We picked the song "She Blinded Me with Science" by Thomas Dolby as our theme song, because it seemed to fit. The very next week, the beginning of the biggest adventure of our collective lives began.

Perry DeAngelis volunteering from the audience of the *Ricki Lake* show.

Steve was, and always has been, the soul inside the *SGU*. His drive and conviction inspired all of us to consistently make the show week after week. Today, we have not missed publishing a show in twenty years. All throughout, he taught us how to conduct research, how to write, and how to think logically and critically. His force of will manifested the podcast into reality, and he honed it to podcasting perfection. Steve took us with him on an epic adventure. We have traveled extensively. We have met amazing people and had the pleasure to entertain, educate, and learn from them all. We've met many of our heroes and, in several instances, became friends with them. We've made lifelong friendships that would never have happened without the podcast. We all had to evolve to meet the challenge Steve presented us with. In that growth, we all found better versions of ourselves that I doubt would have emerged without it.

I think it's important to note that all the time and energy Steve put into his activism was alongside his full-time job as an associate professor of neurology at Yale University School of Medicine. People often ask how Steve accomplishes his full-time job, writing multiple blogs, researching the latest show, recording the show, doing postproduction on the show, frequent interviews, and being a father and a husband week after week. It's a combination of efficiency, skill, and hard

Steve Novella (far left) accepting a samurai sword from Jay Novella during the 1,000th episode of *The Skeptics' Guide to the Universe*.

work. There is no secret.

Without Steve, there is no *SGU*.

I've been looking up to Steve my entire life—from our days as kids when I used to steal his books to the two of us running the *SGU*. He's been my brother, my friend, my boss, and, legitimately, my hero. During our 1,000th episode recording in Chicago, I presented Steve with an accomplishment award. Working so closely with Steve for so long, I have seen his rock-steady hard work and dedication. I felt that he deserved acknowledgement for what I consider a Herculean effort. The award is a katana, also known as a samurai sword. I picked this because Steve is an intellectual warrior.

I noted that Steve's personal philosophy has a lot in common with Bushido, the samurai philosophy—honor, duty, loyalty, responsibility. To add to that, Steve introduced us to a cornerstone of his own philosophy, neuropsychological humility: the idea is that we all must accept the fact that there are massive gaps in our knowledge and understanding of most things. We should always defer to the experts and never overestimate our own capabilities. We need this humility to help keep us honest with ourselves. Over the years, intellectual humility has enabled us to freely accept when we are wrong and change our opinion on a dime without pride or embarrassment.

For the past thirty years, Steve made it his life's work to teach us how to think critically and find the truth for ourselves. Today, more than ever in my lifetime, the lessons I learned from him are critical. They impact my every thought and perception. Steve taught me that skepticism is not cynicism or negativity; it's about curiosity, honesty, and the courage to admit when you're wrong. It's a lesson I've carried into every corner of my life. And I know I'm not alone. Anyone who has listened to Steve, whether through the *SGU* or his countless talks, has felt that same nudge to think just a little more critically and question just a little more deeply. As we stand on the other side of twenty years and 1,000 episodes, I know one thing for sure: our skeptical adventure isn't over. The world needs critical thinking more now than ever in my lifetime. Steve will still be there, leading the charge with relentless passion and integrity, and I'm proud to be on that journey with him. ■

Note

This article was adapted from a presentation given during the 1,000th episode live event recording of *The Skeptics' Guide to the Universe*.

Jay Novella is a skeptic, podcaster, and coauthor who's been fighting pseudoscience since dial-up internet was around. He cohosts *The Skeptics' Guide to the Universe* podcast, where he's spent decades expertly side-eyeing nonsense.

Opening remarks of the 1,000th episode of *The Skeptics' Guide to the Universe*. From left to right: George Hrab, Cara Santa Maria, Steven Novella, Jay Novella, Bob Novella, and Evan Bernstein. (Image credit: Stephen Hupp)

1,000 Episodes! An Insider's Take on *The Skeptics' Guide to the Universe*

GEORGE HRAB

Editor's note: George Hrab wrote this article for Skeptical Inquirer *to honor* The Skeptics' Guide to the Universe *podcast. During the recording of the 1,000th episode, these sentiments also served as his opening remarks.*

If you ever need to make the seven-hour car ride from New Zealand's capital city of Wellington to its often-mistaken-for-the-capital-city of Auckland, I strongly recommend that you have *The Skeptics' Guide to the Universe* (*SGU*) podcast accompany you in your vehicle. Now to be clear, I don't mean "listen to the show while you drive"; I mean literally have the cast members in the car with you. Seriously. I suppose my advice would be the same for *any* long car ride, but if you can swing the New Zealand thing, trust me. Go for it. I can wholeheartedly give this advice as somewhat of an expert on *SGU*-based motoring adventures, seeing as I got to experience that very kiwi-kilometric trip.

Now, I've been lucky enough to have shared many a car ride, van excursion, airline flight, conference platform, elevator ascension, and buffet line with the members of *SGU*. But trust me when I say there are few memories that will ever supersede driving by Mount Ngauruhoe (used as the stand-in for Mount Doom during the filming of Peter Jackson's *The Lord of the Rings*) and having three Novella brothers and a Bernstein collectively lose their mithril over its imposing majesty and nerd-based cultural significance. And as if witnessing a reaction like that weren't itself enough of a reason to be in the car with this crew while driving past freakin' *Mount Doom*, there's also the incredible fact that any time spent within a confined space with these podcasting giants results in the most varying and entertaining of conversations imaginable. I've joked before that if you ever need to have three hours pass by effortlessly, just casually ask show host Steve Novella, "So Steve … how do our brains perceive color?" or "Steve, I was wondering, which edit of

Blade Runner do you think is the best?" and as if by magic, 180 minutes will fly right by. It's quite incredible.

Okay. Let me back up. For those of you who may be unaware (and considering both the demographic of Skeptical Inquirer's readership and the enormous reach and audience of the *SGU*, *that* potential number is no doubt tiny), the *SGU* is an exceedingly popular and award-winning podcast that has been casting its pods since May 2005. Hosted by Steven Novella, its cast includes Bob Novella, Jay Novella, Evan Bernstein, and Cara Santa Maria. For almost twenty years, the show has been "dedicated to promoting critical thinking and science literacy through insightful content and resources," and quite amazingly it just recorded its 1,000th episode.

One thousand. It's kind of a big deal.

To put it in perspective: If you were to listen to all 1,000 episodes of the *SGU*, it would take you over nine weeks of listening twenty-four hours a day—every day—to get through them all. (As a comparison, you could zip through every single episode of *The Simpsons*—TVs longest running prime-time series—in just eleven diddly days.) During those nine weeks of audio immersion, you would get to listen to not only the most in-depth and insightful conversations about myths, conspiracy theories, the paranormal, superstition, space travel, medicine, movies, education, real science, pseudoscience, real history, pseudohistory, misinformation, disinformation, and innumerable other subjects, but you'd also hear countless interviews with authors, scientists, celebrities, artists, musicians, doctors, philosophers, journalists, advocates, a certain "Science Guy," and even a former president. *Plus* you'd realize that Steven Novella has been in every single episode. It's rather appropriate that the *de facto* voice, producer, and overseer of the podcast has been a part of each and every show, a distinction held only by him.

Next, if legitimately starting from the very beginning of the back catalog, you'd notice a surprisingly familiar and consistent structure to the podcast. Episode number one (again, from twenty years ago mind you) shares several factors with the most recent episodes—primarily that host Steve, plus his brothers Jay Novella and Bob Novella along with Evan Bernstein, are all still a part of the entire enterprise. (Original *SGU* member Perry DeAngelis sadly passed away in 2007. Rebecca Watson then became a member of the show from 2008 to 2014, with Cara Santa Maria completing the current lineup in 2015.) Episode number one even had the very first round of "Science or Fiction": a popular end-of-show quiz run by Steve that's been a staple of *SGU* programing and a feature of almost every single episode since the very beginning. It's not insignificant that the "Rogues" (as they call themselves) hit their programming stride pretty quickly.

That's not to say that nothing has changed since those early pre-iPhonian days. Hardly. Along with the inevitable age-related lowering in pitch of some of the voices (plus the variances in the cast), there's also been an incredible amount of self-awareness and alteration of perspective. To wit; historically, the casually familiar valediction of "Hey—don't ever change" has often been heralded as a positive piece of advice. To unflinchingly maintain one's ideology and philosophy is often culturally legitimized as a symbol of consistency and strength. It seems, however, that an absolutely necessary, albeit challenging, aspect of critical thinking and skepticism (the very tenets to which we all aspire) is in having the ability to change. Dealing with the self-aware and uncomfortable realization that our prejudices, experiences, desires, and wants continually color and influence the way we think (regardless of our intelligence, education, or self-labeling) is an essential part of learning and growing. Beautifully, the full history of the *SGU* displays a marvelous narrative arc of being aware of this challenge—and being open to modification of outlook and viewpoint. It's this attitude and approach of continual questioning that allows the discovery of what's really real, as well as what's most likely to be true. I genuinely think the show's capacity to ceaselessly reevaluate itself and its presuppositions is a significant part of the reason the podcast has not only been successful but remains so popular and relevant.

I first met the members of the *SGU* back in July 2008 in Las Vegas, Nevada, where famously—within the first fifteen minutes of meeting him—I made Jay Novella cry. Well, that is to say, Jay and I both cried together, bonding over the loss of our recently deceased pets. (Jay's cat had just passed away, and I had lost my dog a few months earlier.) In hindsight, Jay and I both recognize that that's exactly when and where our love affair started, and because of this mutual and instant grief-based bond, he very generously brought me into the *SGU* fold. I soon became a semi-regular guest, and I eventually became a partner in their live events and special productions. This all culminated with the creation of *A Skeptical Extravaganza of Special Significance*, the *SGU* stage show in which I'm the emcee/host. We've literally traveled the world performing this science-based variety show for thousands of critical thinkers and fans of the podcast. All this to say that I've had quite the unique vantage point for the past fifteen years in observing everyone involved in all that is *The Skeptics' Guide to the Universe*.

Because of that particular perspective, a question I get asked most often by *SGU* listeners is this: "So, what are they *really* like?"

I've always been thrilled to genuinely answer that the "characters" you listen to each and every week are *exactly* the people you think they are. There is absolutely zero pretense with the five rogues who research, write, and record show after show, week after week. If you listen to just a handful of episodes, you quickly come to learn and appreciate the dynamic among everyone, and I can resolutely report that the people you hear *on* the show are identical to what they're like *off* the show. That's why long, cross-continental car trips past fictional Elvish-based geologic strata are so endlessly entertaining with this lot. You literally get real-life podcast after podcast when around this crew, with all its subsequent content just as interesting, varied, and in-depth as any recorded episode. Watching these conversations spin and coalesce into informational smorgasbords is as close to seeing real sorcery as one can ever hope to get. The palpable chemistry between all the rogues is no accident. It's more than just familiarity combined with familial intimacy. It's a perfect example of individuals' understanding about the ingrained and

George Hrab (left) and the SGU cohosts sweeping Steve Novella (not celebrating) while playing his game, Science or Fiction, during a live event in 2019.

immeasurable value in being true to what they inherently are. In the same way that any successful band is always more than just its component members, the individuals who make up the *SGU* all impart a greater-than-cumulative effect on the overall success of the show. It's way more than each person simply providing one-fifth of the content. Namely:

Cara Santa Maria—the newest member of the cast ("newest" being relative here, she's been a part of the team for nearly a decade)—relentlessly yet compassionately challenges assumptions with her important perspective and voice. This critically vital ingredient to the *SGU* formula provides a priceless point of view that the rest of the rogues—and their ever-expanding audience—greatly appreciate and value. Whenever a topic strays toward questionable or clichéd lines of thinking, Cara boldly counters and offers a viewpoint that others may not have considered. I've personally witnessed conversations shifting and beliefs being reconsidered in real time due to Cara's diligent interrogative examining. That's all of course in addition to her being incredibly knowledgeable in myriad fields (not counting *Star Wars* trivia, alas). Even more impressive than her doctorate and multiple master's degrees is Cara's limitless amount of concern and caring that she consistently demonstrates when interacting with listeners of the show. She's a tireless advocate for those dealing with challenges, those whose histories and experiences are similar to hers, and especially those whose needs are to just truly be heard.

Evan Bernstein's earnest disposition, brilliant factual recollection, clinical diligence, comfort in simply listening, and pragmatic capacity to filter out the noise of dubious data (along with his ninja-like ability to quietly and repeatedly insert a limitless supply of puns and dad jokes into any discussion) endlessly impresses listeners of the show. Evan and I happen to share a love of 1970s and 1980s progressive music, with a particular passion focused on Canadian rock icons Rush. What has always impressed me is his true curiosity and appreciation about the process of creating and performing music, something he self-admittedly has little experience in. Evan also has the dubious job of being a Novella brother while not officially being a Novella brother. As anyone who's ever shared a meal with a large Italian family might tell you, it can be quite an overwhelming experience to be thrust into the middle of such a Mediterranean mêlée. Evan always can just float over and around the commotion, remaining the most vigilant of friends, always maintaining a priceless perspective. His "calming constant" centers the show and allows for things to proceed smoothly and efficiently.

While it's true that Bob Novella doesn't like listening to his own voice, the same can't be said for the countless number of fans and subscribers that listen to him effuse excitedly week after week about nanotechnology or some majestically cataclysmic cosmic event that may soon be visible in the night sky. In some ways the least "performative" of the rogues, Bob's true love and appreciation of all things geeky and scientific comes across through his genuine earnestness and excitement. Whether sharing stories of his profuse Halloween obsession or explaining the latest information available about neutrinos, Bob's self-assured yet subtle passion is always apparent. There are portions of our live *Extravaganza* that are purposely designed to gently fluster Bob, and some of my favorite memories and moments on stage are watching him purposefully and confidently take his time

in dealing with anything thrown at him. On top of that, Bob always initiates the kindest and warmest greeting whenever we first see each other. It's proof of his tender-hearted nature and genuine graciousness.

Along with all his relentless responsibilities in helping produce and create each episode, Jay Novella has the distinct and challenging job of representing the "non-expert" on the show. Jay's unending curiosity has him constantly asking for context and explanations whenever any subject gets too deep into the weeds of minutiae. As a listener (and an expert "non-expert" myself), I am constantly grateful whenever Jay asks for something to be reexplained and clarified. It's not an easy place to reside, yet Jay's enthusiastic and inquisitive nature along with his comfort in admitting he doesn't understand something make him the ultimate ombudsman and avatar for many listeners. Most impressive, however, is Jay's limitless capacity for love, caring, and laughter. I have witnessed the lengths to which Jay will try to make listeners feel comfortable and important. I've heard his throaty laugh from across the room when reacting to a story told by a lifelong friend or complete stranger. I experienced it myself that first time we bonded over our shared grief, and it's always been something that has added to that unique stew that makes up the *SGU*.

Finally, there's Steven Novella. It's difficult to not speak in superlatives when talking about Steve. Common sense dictates that one is supposed to say that some special individual one knows is "*among* the smartest," "*one of* the hardest working," or "*in the top five*" of any kind of description. I mean—we all know a lot of people, right? How can any one person be *the* anything? Well … Steve is the smartest and hardest working person I know. Full stop. It's a bit annoying actually. And most folks who know Steve would agree. (About the smart, hard-working thing. Maybe the annoying thing too … not sure. I mean, not that *he's* annoying mind you, but just the general idea … I know you get it. Anyway …) What's most frustratingly impressive about Steve is that his expertise and industriousness is not limited to any one particular field or focus. There's an uncanny amount of information that is readily available at Dr. Novella's brain-tips. From hard science to pop-culture to history to trivia to honestly just about anything, Steve seems to have instant retrieval capacity from his cerebral hard drive. He also accesses all that data through a truly self-critical and questioning lens, so that any facts and information that do come up are always presented in a hyper-aware way. He's never just blindly dispensing gospel. In those instances where Steve may actually be vehement about something, it's a pretty sure thing that you can take what he's saying to the metaphorical bank. Along with all this, Steve—just like the whole team—is a truly decent person. I once saw him instantly become "Dr. Steve" and calmly soothe and tend to a completely random airplane passenger who suddenly felt seriously ill. It was beyond impressive. It's Steve's personality, perfectly combined with his breadth of knowledge and an unbelievable work ethic, that's enabled him to endlessly inform and educate countless numbers of people. He's driven to maintain the high level and consistent quality of his podcast not for any aggrandizement but simply because it's the right thing to do.

That does beg the question: Is it making a difference?

When one looks at the state of the world and worries about the prevalence of pseudoscience and non-critical thinking, the re-writing or ignoring of history, and the rise and re-invigorated popularity of long disproven nonsense, it can get disheartening. The *SGU* has been valiantly fighting against the tide for decades, diligently trying to educate and inform the public. At times, however, it's natural to wonder if it's been worth it. Has it made a difference? Has it really mattered?

Well …

Through my tangential participation with the *SGU*, I've heard a countless number of individuals tell the same tale of discovering the podcast and being "rescued" by them. Again and again, from every demographic imaginable, from every corner of the world, I've talked with people who discovered the *SGU* and subsequently had it change their lives. Stories of true believers slowly realizing that what they believe may not be so true … non-critical thinkers discovering the majesty and efficiency of thinking critically … even lone skeptics in isolated communities finally hearing voices they agree with and getting the chance to revel in shared moments of comprehension and recognition. These examples of precious and true redemptions are impressive and sometimes emotionally overwhelming. The unrelenting (and uniquely non-dogmatic) proselytizing that the *SGU* has been endlessly undertaking for all this time has resulted in the "saving" of countless minds, literally across the entire planet.

I think for those people, it's made a difference. It's really mattered.

Before episodes of the *SGU* are recorded, there's normally a few minutes of banter and salutations, plus a review of the topics that are going to be discussed. I'm lucky enough to have been a guest so many times that I'm usually a part of this pre-show ritual. Occasionally, when reviewing the stories that are going to be covered, there may be one news item so full of woo or credulous nonsense that it sometimes elicits a semi-joking comment of "should we even bother recording this week?"

My standard reply is: "Imagine how much worse it might be if you didn't?"

I don't know what a world without *The Skeptics' Guide to the Universe* would look like, but it's definitely one I would not want to live in.

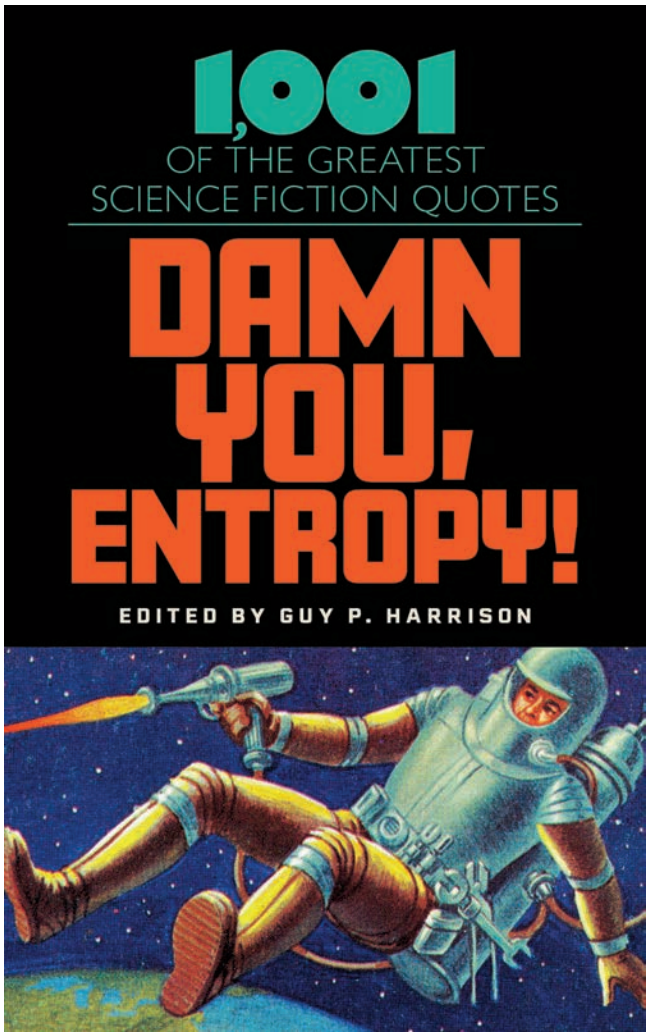
Congratulations, Steve, Jay, Bob, Evan, and Cara. On behalf of all the listeners who have been endlessly influenced, entertained, informed, and awed by what you do, thank you for 1,000 episodes. ■

George Hrab is a multi-instrumentalist, singer, songwriter, science advocate, producer, composer, and vigilant defender of the theory of gravity. He's released nine albums of original music, produced over 900 episodes of *The Geologic Podcast*, written two books, and emceed countless science conferences all around the world. His latest album is titled *Terpsichore* and is a funky throwback and homage to the infectious music he grew up with.

Close Encounters at the Crossroads of Critical Thinking and Science Fiction

GUY P. HARRISON

Note from Evan Bernstein (Quote Master for The Skeptics Guide to the Universe *podcast): In this article, Guy P. Harrison digs deep into the human imagination's greatest frontier: science fiction. Harrison does the heavy lifting for readers by retrieving sci-fi literature's most poignant quotes in support of helping people become better critical thinkers. This article and his related book are both fun and illuminative. They are also very effective. Why do people love good quotes? Quotes are a highly efficient way of communicating a thought or an idea. Quotes are densely packed nuggets of information, and the human brain delights in these easily digestible treats. Quotes germinate well when planted in a person's field of thoughts, to grow and one day be shared anew. Basically, people love good quotes because quotes make us feel good about an idea—and about ourselves.*



Science fiction is frequently praised for inspiring better technology. It is celebrated less often, however, for inspiring better thinking. The genre certainly deserves more recognition for promoting critical thinking because for many years science fiction writers have been baking into their stories calls for logic and reason, as well as warning us about lazy or corrupted minds dooming whole societies. Critical-thinking advocates and all who hope for a saner world may want to give this unique form of entertainment due respect and more attention for its contributions to the cause.

Altering course from my usual focus on writing nonfiction books with science and critical-thinking themes, I produced *Damn You, Entropy! 1,001 of the Greatest Science Fiction Quotes* (Rowman and Littlefield/Prometheus Books, 2024). I'm a lifelong fan of science fiction, having been assimilated early in childhood by reruns of the original *Star Trek* series and *The Time Machine* novel. This was my secret passion project, the book I worked on between books. But a funny thing happened on the way to amassing my personal treasure of more than 3,000 intellectually impactful and context-independent quotes. I discovered that science fiction literature, films, and television series give specific nods to critical thinking far more often than I would have thought.

I separate quotes into many topics, most of which one would expect in a book of this kind (e.g., space exploration, artificial intelligence, time travel, extraterrestrials). To my surprise, however, quotes about "reality" and "critical thinking" were as brilliant and nearly as abundant as any other. I cringed in horror when my publisher asked me to shrink the manuscript down to a more manageable and price-friendly 1,001 quotes. They soothed me with happy talk of a possible second volume later. Still, I knew it would hurt to cut so many great quotes about robots, First Contact, dystopian societies, etc. It turned out that reducing the number of quotes about skepticism and scientific thinking was no easier. Yes, personal bias probably led me to notice and save these particular kinds of quotes more than someone else might have. Nonetheless, they were there; I didn't imagine or invent them.

Every good science-fiction writer has an elite imagination,

of course, but many of them are no slouches when it comes to serious thoughts about serious thinking, either. The best can transport the minds of readers or viewers to far horizons—while keeping them loosely tethered to reality. Given the human brain's vulnerability and compulsive attraction to stories, those who wish to encourage more thoughtful societies may want to consider adding a few relevant science fiction stories, characters, and quotes to their arsenal of ways to reach and inspire others. Some good examples include: *Things to Come*, a 1936 film written by H.G. Wells; the Spock character in *Star Trek*; James L. Powell's novel *The 2084 Report*; the novel *Contact* by Carl Sagan; *Dr. Who's* The Doctor character; and Aldous Huxley's novel *Island*.

The best science fiction entertains while simultaneously shaking and waking the sleepy mind. Science fiction excels at cracking open confining shells of harmful traditions, comforting-but-problematic beliefs, and inept mental routines. Much of it challenges perceived limitations, expands vision, frees thoughts—all while sprinkling in just enough realism and possibility to matter. This ability to make one reflect on the real while under the spell of an unreal tale makes it highly effective at going after lame ideas and bad beliefs. Some works are like a passkey to locked doors in our minds and can facilitate meaningful real-world analysis and skepticism.

This genre also gives us a way to test drive unlikely events and absurd technology without wrecking our brains. A great science fiction story can take a three-pound human brain and stretch it across multiple universes, squeeze it to fit inside an atom, or show it eternity in a moment. Science fiction lets us experience crazy thoughts without going crazy and indulge in intergalactic nonsense while thinking about serious issues down here on earth. There may be something practical and psychologically healthy in that for all of us.

Our species depends on high-quality thinking for its success and survival—yet how many people place sufficient value on the quality of their thinking today? Many science fiction works challenge us to *do* better by *thinking* better. They call on humankind to grow up and finally earn that "wise man" title we prematurely bequeathed ourselves. These kinds of stories can deliver helpful messages in a time when high-tech means are amplifying and distributing misplaced fears, dangerous delusions, and creative deceptions at unprecedented rates.

Somehow, we have created a science-dependent civilization with a fair share of people who either don't know much about science or outright engage in science denial. The growing problem of smart technology digitizing and weaponizing faulty thinking may be the death of us. Those who are concerned about the state of our species and desire a sustainable and more rational human future must work harder, faster, and smarter to help make it happen. This means tapping all available resources, including science fiction.

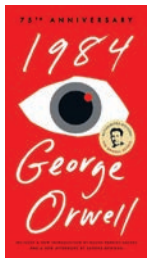
The following quotes are a small sample of the substantial support science fiction gives to the cause of thinking well and accepting reality as we discover it. Enjoy them, ponder them, and, most importantly, share them. Smart ideas can go viral, too.

"The vast unknown of nature, so vast that everything which was real to me, understandable to me, was a mere drop in the ocean of the existing unknown."

—Ray Cummings, *Phantoms of Reality*, 1930 novel

"People must think for themselves."

—H. G. Wells, *Things to Come*, 1936 film



"Until they become conscious they will never rebel, and until after they have rebelled they cannot become conscious."

—George Orwell, *Nineteen Eighty-Four*, 1949 novel

"His mind could be his salvation, as it had been his damnation."

—Richard Matheson, *The Shrinking Man*, 1956 novel

"Ignorance is king. Many would not profit by his abdication. Many enrich themselves by means of his dark monarchy."

—Walter M. Miller Jr., *A Canticle for Leibowitz*, 1959 novel

"We cannot reason ourselves out of our basic irrationality. All we can do is to learn the art of being irrational in a reasonable way."

—Aldous Huxley, *Island*, 1962 novel

"Hope clouds observation."

—Frank Herbert, *Dune*, 1965 novel

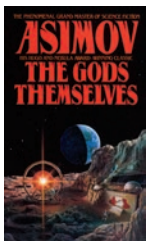
"In this age of enlightenment, the soothsayer and astrologer flourish. As science pushes forward, ignorance and superstition gallop around the flanks and bite science in the rear with big dark teeth."

—Philip Jose Farmer, *Riders of the Purple Wage*, 1967 novel

"Insufficient facts always invite danger."

—Gene L. Coon and Carey Wilber, said by Spock, "Space Seed," 1967 episode of *Star Trek*

"He felt all at once like an ineffectual moth, fluttering at the windowpane of reality, dimly seeing it from outside."
—Philip K. Dick, *Ubik*, 1969 novel



"I fear my ignorance."
—Isaac Asimov, *The Gods Themselves*, 1972 novel

"She had discovered long ago that you could use a computer without understanding how it worked. Just as you could use an automobile, vacuum cleaner—or your own brain."
—Michael Crichton, *The Terminal Man*, 1972 novel

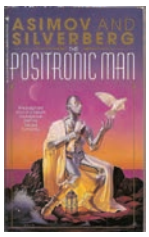
"It's always easier not to think for oneself. Find a nice safe hierarchy and settle in."
—Ursula K. Le Guin, *The Dispossessed*, 1974 novel

"Your eyes can deceive you. Don't trust them."
—George Lucas, said by Obi-Wan Kenobi, *Star Wars: Episode IV—A New Hope*, 1977 film

"Never be certain of anything. It's a sign of weakness."
—Chris Boucher, "The Face of Evil: Part one,"1977 episode of *Dr. Who*

"Learn all that is learnable."
—Harold Livingston, *Star Trek: The Motion Picture*, 1979 film

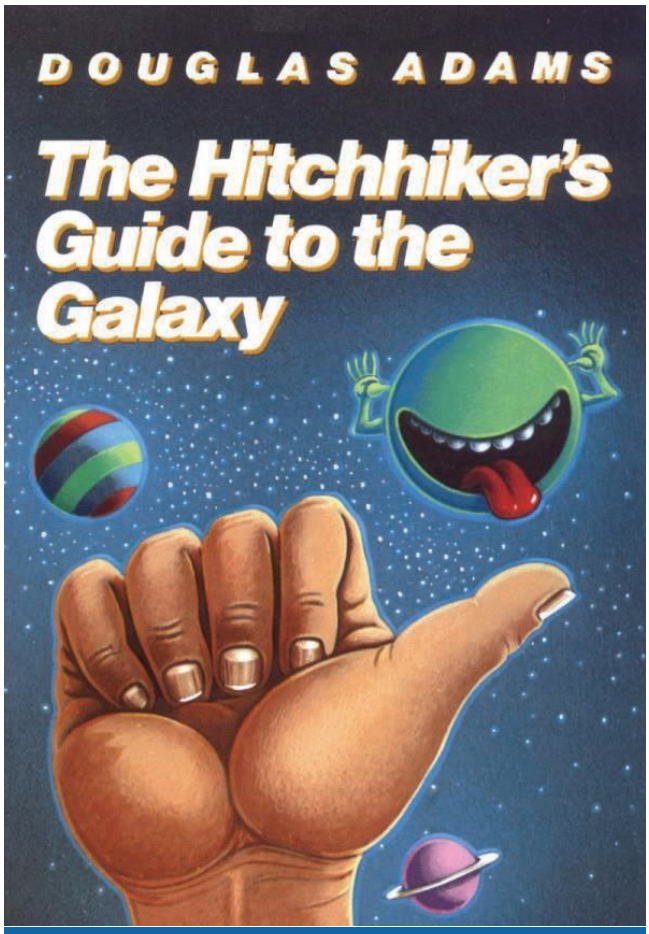
"It is possible to build a rational and humane culture completely free from the threat of supernatural restraints."
—Arthur C. Clarke, *The Songs of Distant Earth*, 1986 novel



"We are a sloppy-minded species, aren't we? Brilliant and tremendously creative at times, but full of all sorts of messy little contradictions and confusions."
—Isaac Asimov and Robert Silverberg, *The Positronic Man*, 1992 novel

"It is always hard when reality intrudes on belief."
—Alan Dean Foster, *Cyber Way*, 1990 novel

"I seek enlightenment, not spiritual but rational."
—Ted Chiang, "Understand," 1991 short story



"Isn't it enough to see that a garden is beautiful without having to believe that there are fairies at the bottom of it too?"
—Douglas Adams, *The Hitchhiker's Guide to the Galaxy*, 1979 novel

"The most insidious lie is the one you want to hear."
—Lois McMaster Bujold, *Barrayar*, 1991 novel

"Most ignorance is by choice, you know, and so ignorance is very telling about what really matters to people."
—Kim Stanley Robinson, *Red Mars*, 1992 novel

"Earthlings had to figure it all out for themselves. Slowly, agonizingly, humans learned how the universe worked, abandoning most of the fanciful beliefs they carried through their long, dark loneliness."
—David Brin, *Brightness Reef*, 1995 novel

"The ship of theory could set sail on tides of mathematical grandeur and hope alone, but only data could fill its sails."
—Gregory Benford, *Cosm*, 1998 novel

"The capacity to learn is a gift; The ability to learn is a skill; The willingness to learn is a choice."
—Brian Herbert and Kevin J. Anderson, *House Harkonnen*, 2000 novel

"If Earth was ever to be saved, its people would have to be taught to believe in reason."
—Robert Zubrin, *The Holy Land: A Tale of a Universe Mad Enough to Be Our Own*, 2003 novel

"Ignorance was the enemy. Lies and superstition, misinformation, disinformation. Sometimes, no information at all. Ignorance killed billions of people. Ignorance caused the Zombie War."
—Max Brooks, *World War Z: An Oral History of the Zombie War*, 2006 novel

"It's a strange thing: We humans pride ourselves on being ruled by reason, yet with human civilization at stake, we chose ideology and ignorance."
—James Lawrence Powell, *The 2084 Report: A Novel of the Great Warming*, 2011 novel

"For all its beauty, honesty, and effectiveness at improving the human condition, science demands a terrible price—that we accept what experiments tell us about the universe, whether we like it or not."
—David Brin, *Existence*, 2012 novel

"The admission of ignorance is the beginning of wisdom."
—James Edwin Gunn, *Transcendental*, 2013 novel

"Believe isn't the right word. Things either are or they aren't in science."
—Gregory Benford, "Vortex," 2016 short story

"Humans are driven by emotion. Much of our so-called logic is merely the rationalization of choices that make us feel good."
—David Walton, *The Genius Plague*, 2017 novel

"All the courage in the world cannot alter fact."
—Hampton Fancher and Michael Green, *Blade Runner 2049*, 2017 film

"You're not even consciously aware of the world until your brain has filtered and censored and hammered it down into a mush of self-serving Darwinian dogma. The cataracts on your eyes are four billion years thick; it's amazing you can see anything at all."
—Peter Watts, "Kindred," 2018 short story

"Science is an attempt to remove our emotions and ego from reality."
—Peter Cawdron, *Losing Mars*, 2018 novel

"Scientists are often seen as turbonerds, but the philosophical foundations of science are actually those of pure punk-rock anarchy: never respect authority, never take anyone's word on anything, and test all the things you think you know to confirm or deny them for yourself."
—Ryan North, *How to Invent Everything: A Survival Guide for the Stranded Time Traveler*, 2018 guidebook

"Our species doesn't operate by reality. It operates by stories."
—Becky Chambers, *Record of a Spaceborn Few*, 2018 novel

"That little voice, convinced of its lordship over the empire of your brain, is less than sea foam, carried over the deep waters of your mind."
—Scott Base, "Behind Your Eyes," 2021 comic

"Nothing can bring you peace but the triumph of reason—no edicts, no beliefs, no rules or regulations. No one can do this for you. No one."
—Peter Cawdron, *Cold Eyes*, 2021 novel

Science fiction's predictive powers are less than advertised (or hoped). Given the genre's long span of time and volume of work, it is likely that some writers would accurately anticipate some events and technologies. Think of psychics who make countless predictions, some of which inevitably come true. Science fiction is special and important because of the intellectual inspiration it delivers and its knack for pushing us to ponder the possibility of "impossibilities."

It is good that we have imaginative stories about faster-than-light travel, First Contact, and time machines tumbling around in pop culture. Such tales almost certainly help nudge our collective consciousness toward deeper considerations of weird and elusive realities. We know enough about the cosmos, large and small, to suspect that our brains may be inadequately evolved to readily grasp all that is going on around us. Much like a runner preparing for a big race, science fiction offers us the cognitive warm-up and cerebral stretching humankind needs to perform at its best. ■

Guy P. Harrison is an award-winning writer and author of nine books, including *Damn You, Entropy! 1,001 of the Greatest Science Fiction Quotes*, *At Least Know This: Essential Science to Enhance Your life*, and *Good Thinking*.

The Younger Dryas Impact: A Failed Hypothesis

The impact hypothesis, which has received much popular attention, is incompatible with the purported evidence as well as with scientific understanding of cosmic impacts.

CLARK R. CHAPMAN, DAVID MORRISON, AND ALAN W. HARRIS

For over a century, scientists have been intrigued by a millennium of relatively cool temperatures that interrupted global warming near the end of the most recent ice age in at least parts of the northern hemisphere. This climate oscillation began roughly 12,900 years ago and ended about 1,200 years later. It is named the Younger Dryas (YD) for the *dryas octopetala* European wildflower that thrived during the YD. The YD is especially interesting because several species of North American megafauna (including mammoths and saber-toothed tigers) went extinct around this time, and it is also when the Clovis culture Paleo-Indians apparently stopped making their unique stone spear points.

The 1980 discovery that a cosmic impact caused the end-Cretaceous (K-Pg) mass extinction sixty-six million years ago created a receptive audience for the suggestion that a cosmic impact caused the YD. It first appeared in a fringe 2006 book (*The Cycle of Cosmic Catastrophes: How a Stone-Age Comet Changed the Course of World Culture*) by nuclear chemist Richard Firestone and colleagues, then by publication in a scientific journal (*Proceedings of the National Academy of Sciences*, Firestone et al. 2007), suggesting that a possibly 4 km impactor (or equivalent swarm of smaller fragments) exploded over North America or impacted the ground, somehow initiating YD cooling. The late Pleistocene had other warming pauses; a flaw in the impact hypothesis is treating the YD as unique, requiring an extraordinary cause.

The science community was immediately skeptical about this Younger Dryas impact hypothesis (YDIH). Richard Kerr (2008) wrote that the YDIH data "don't agree with anything we know about impacts." Ocean circulation expert Wallace Broecker said that an impact was not needed to explain the YD, which would have happened anyway. One of us discussed YD scientific issues in Skeptical Inquirer (Morrison 2010). In summary, Nicholas Pinter and colleagues (2011) wrote what they called a "requiem" for the YDIH, concluding that "recognized and expected impact markers were not found, leading to proposed impact processes that were self-contradictory, rapidly changing, and sometimes defying the laws of physics."

YDIH advocates persisted and subsequently developed the thesis of a broad catastrophe with alleged impact evidence across Earth's western hemisphere. A wide-ranging, self-published e-book advocating the YDIH by geologist, former college president, and former CSI Fellow James Lawrence Powell (2020) is *Deadly Voyager: The Ancient Comet Strike that Changed Earth and Human History*.

YDIH supporters calling themselves the Comet Research Group (CRG) currently list sixty-three members. The apparent leader of the CRG and frequent coauthor of YDIH publications is Allen West. Despite the group's name, little of its research concerns comets, and few members have expertise in astronomy or cosmic impacts, two disciplines highly relevant to the YDIH.

Causes of the multiple Pleistocene climate oscillations have been widely researched and debated. The favored hypothesis is that YD cooling resulted from a reduction in the North Atlantic system of ocean currents (such as the Gulf Stream) that circulates warm tropical waters northward. The slowdown was likely triggered by draining of Ice Age Lake Agassiz in southern Canada, flooding the North Atlantic with fresh water, creating a buoyant layer preventing cold water from sinking, thus breaking the circuit that keeps the currents flowing.

We do not doubt that the YD cooling happened, and here we will not discuss the potential aftereffects of the YD (e.g., on Paleo-Indian culture or megafauna extinctions). Instead, the issue we address here is whether the YD was triggered by a major cosmic impact.

The Impact Hypothesis

Scientific understanding of the K-Pg impact sixty-six million years ago is straightforward: a rocky body (~10 km diameter asteroid) struck just offshore of the Yucatan peninsula, excavating a crater (Chicxulub) 180 km in diameter and lofting a vast debris cloud that spread around Earth, reentering as countless fireballs, broiling our planet's surface; remaining debris darkened the skies, producing a poisonous and deadly "impact winter." A YD impact event, if one happened, must have been very much smaller, because no impact crater has been found, and no global mass extinction happened. A YD-aged impact in Greenland was claimed by YDIH advocates following the 2018 discovery of a circular feature 31 km in diameter under the Hiawatha glacier. Though it is not certainly an impact crater, an age of fifty-eight million years was published. If it turns out to be an impact crater when drilled, lack of ejecta in Greenland ice cores would confirm that it is too old (Boslough 2022). Greenland has been cratered for billions of years, so shocked quartz—a classic marker for such impacts—reported in a stream from beneath the ice may be unrelated to the circular feature. An alternative suggestion that the Carolina Bays (thousands of shallow erosional depressions) are remnants of a YD impact is untenable because these are not impact features and are also the wrong age.

YD impact proponents (e.g., Pino et al. 2019) suggest three different scenarios: (1) impact by a single km-scale object; (2) impact by an exploding comet; or (3) near-simultaneous impacts by thousands of comet fragments. They favor impacts by comets rather than asteroids, although asteroid impacts are much more common.

We have devoted our professional lives to studying comets and asteroids and their impacts on the Earth, Moon, and planets. We cannot understand these YDIH scenarios. It is extraordinarily unlikely that a large comet could break up near Earth and strike it in the way claimed. Comets do not "explode" in space. Disintegration of a comet or asteroid caused by another process before impact would disperse into a long-lasting asteroid or meteor stream.

While scientists have never confirmed a *comet* impact on Earth, *asteroid* impacts have been studied for over a century. There are hundreds of impact craters on Earth (e.g. Arizona's Meteor Crater) and millions on the Moon and other planets. Astronomers have discovered and tracked over a million asteroids. Spacecraft have visited, landed upon, and even struck asteroids and comets. The resulting information provides a context for evaluating proposed YDIH scenarios.

Depending on impactor size and composition, cosmic strikes can be either airbursts like Tunguska in 1908 or crater-forming ground impacts like Meteor Crater. The damage resembles that from a large bomb and is modeled using sophisticated physics software developed to design nuclear weapons and simulate their effects. Studies of impacts and impact craters interest scientists and engineers concerned with planetary defense against a rare asteroid impact; the recent NASA DART (Double Asteroid Redirect Test) spacecraft struck a distant small asteroid, successfully changing its orbit. Curiously, planetary defense seems not to interest most YDIH advocates, despite the CRG website's warning about comet impacts and incorrectly stating, "Killer comets are more common than you have been taught, and our mission is to raise awareness before your city is next."

YDIH literature says little about exactly how an impact would lead to a YD cooling. They suggest that extensive wildfires triggered by an impact, improbably even greater than caused by the K-Pg impact (Wolbach et al. 2018), may have done much environmental damage. Widespread biomass fires certainly occurred in the historical and palaeoecological record not requiring such an extraordinary explanation.

YDIH papers since Firestone and colleagues (2007) reveal no consensus about what kind of cosmic impact is at the heart of the hypothesis, although recent publicity often features the multiple comet fragment idea. They are vague about the size of the impactor, with James Kennett (2023) even suggesting one as small as a few hundred meters diameter, but the scale of alleged damage seems to require a much larger comet as originally suggested by Firestone and colleagues (2007). The YDIH is handicapped by failure to find any associated crater or other convincing evidence of a Younger Dryas boundary (YDB) impact by a comet (or asteroid).

Evidence for a Cosmic Impact: 'Boundary Sites' and 'Markers'

Alleged evidence for the YDIH has three elements: materials (often microscopic), locations, and dates (ages). Because, as we will show, it is so extremely unlikely that a large comet struck Earth so recently (and so important if it did), how robustly does this evidence support a comet impact rather than another cause? The YDIH was originally based on the discovery of allegedly extraterrestrial or impact-related materials at various locations (e.g., the youngest Clovis culture sites) that have been radiocarbon dated roughly to the start of the YD. YDIH proponents call them YDB sites. By circular reasoning, a location is often said to be at the YDB if it yields alleged extraterrestrial or impact materials (termed *markers* or *proxies*), even if it is not well dated or otherwise identified as a YDB. Dozens of such supposed sites are in North America, Europe, South America, western Asia, and Africa. These areas of accumulation in ponds, lakes, or ice fields are rarely near proposed impact sites; markers are sometimes alleged to have been airborne and unrealistically traveled hundreds or thousands of kilometers. Some layers that YDIH advocates link to impact are so-called "black mats," often dark-colored, carbon-rich layers, including some algal mats with microspherules and soot. But such mats were often deposited in wet locations during cooler climate intervals, having no connection to an impact.

Presence of extraterrestrial materials could imply a cosmic event but are often ambiguous. YDIH "markers" include enhancements of platinum-group metals, microspherules, nanodiamonds, alleged microimpactites (mixtures of target rock and meteorite-like materials), soot, charcoal, and other supposed impact debris. Shocked quartz has features that are diagnostic of the enormous pressures of an asteroid impact but is rarely mentioned in YDIH literature and is not expected from non-crater-forming airbursts because shock pressures are far too low. Examples of shocked quartz recently claimed by YDIH advocates fail to meet established criteria. Another problem is that many of the purported YDB sites have been modified by human habitation. Anthropogenic contaminants such as fly ash and foundry slag have not been ruled out. Fossilized fungus and insect fecal pellets have been misidentified as YDIH impact markers, and some car-

bon spherules said to contain nanodiamonds have modern radiocarbon ages. None of the alleged extraterrestrial markers provide proof of a major impact by diagnostic criteria widely accepted by meteorite and asteroid impact researchers (e.g., shatter cones, tektites, high pressure phases, and minerals showing obvious shock metamorphic microstructures).

What is fundamental, but never demonstrated with statistical significance, is whether supposed YDB layers were deposited at the same time. Radiocarbon dates of varying precision are sometimes uncertain by many centuries. Other datings by annual layering and geochemical techniques in Greenland ice cores are uncertainly correlated with dates of stratigraphic layers identified elsewhere. Excepting YDB sites that have not even been dated at all, the increased number of dated sites has led to a larger scatter in ages, not a convergence (Holliday et al. 2023), suggesting multiple events over a range of dates, not an impact catastrophe at a single time. The Laacher See volcanic eruption in Europe, just before the YD onset (within error bars of some YDIH ages), could have contributed some of YDIH promoters' alleged markers (such as microspherules). Other natural terrestrial phenomena (the very greatest floods, volcanic explosions, lightning superbolts, meteor storms, wildfires) occur so rarely that you are very unlikely to have witnessed one in your lifetime, but one could well have happened in the western hemisphere about 13,000 years ago and created some of these charcoal beds, melted grains, and other so-called markers.

Microspherules with meteoritic compositions rain down every day as interplanetary dust particles or products ablated off incoming meteoroids penetrating our atmosphere. Clustering in a layer is almost never evidence of a huge impact. Meteor showers happen annually and occasionally are very large (the Leonids produce "storms" a few times a century). Very large meteors (bolides or superbolides) occur somewhere on Earth every day, leaving local concentrations of extraterrestrial "markers."

Much YDIH "evidence" is about layers enriched in platinum. While platinum is highly enriched in extraterrestrial materials compared with Earth's crustal rocks, platinum enrichments in meteorites are accompanied by enrichments of certain other elements, such as osmium and iridium, in proportions called cosmic (or solar) abundances. As Wendy Wolbach and colleagues (2018) admit, platinum enrichments in alleged YDB layers are not generally accompanied by enrichments of other relevant elements in cosmic proportions. Their paper therefore chooses to call the YD impactor a "comet" because cometary nuclei compositions are less well-known than asteroid compositions. But much is in fact known about comets; they aren't just "black boxes." Comets are hardly expected to have wildly non-cosmic compositions. Moreover, reported YDIH Pt spikes are relatively weak and often do not date at the age of the YDB. So, platinum enrichments are highly suspicious as valid indicators of a major impact.

The story of the 2009 episode of the PBS *Nova* series, titled "Megabeasts' Sudden Death," is instructive. It reported discovery of nanodiamonds as impact markers at a claimed YDB in the Greenland ice sheet. The dramatic final scenes were in an electron microscope lab at UC Santa Barbara, where James Kennett got his first look at highly magnified images of a sample. Kennett described his impressions: "This has huge implications. There is no way you are going to get these kinds of particles in the ice sheet unless they are raining out of the atmosphere. This is art, to me, a Mona Lisa image … Moments of intense discovery are very emotional for scientists … The hypothesis predicts that the diamonds should have been there, and there they were!" Notably, however, no other researchers can reproduce this finding; results from a subsequent Greenland expedition to collect ice samples remain unpublished. *Nova* eventually withdrew this episode from streaming.

In a major effort to resolve issues concerning YDIH "markers," a team of thirteen independent experts spent a year deeply exploring this topic, with a comprehensive report in *Earth-Science Reviews* (Holliday et al. 2023). They summarize their conclusions as follows:

> Very few sites with high levels of any of the purported indicators have accurate and high precision dating to 12.9 ka. The identification and quantification of several purported impact indicators is also questionable. The claim that a suite of supposed indicators is unique to that moment is not substantiated with data. There is no obvious evidence of environmental cataclysm at that time in the vast published paleobotanical records … Evidence and arguments purported to support the YDIH involve flawed methodologies, inappropriate assumptions, questionable conclusions, misstatements of fact, misleading information, unsupported claims, irreproducible observations, logical fallacies, and selected omission of contrary information.

Comet Behavior and Impact Frequency

Concern about danger from the skies is as old as civilization. The idea of a contemporary danger from comets predates works of Firestone and the CRG. William Napier and Victor Clube published claims in the 1980s of cosmic impact catastrophes, followed by books intended for the public: *The Cosmic Serpent* and *The Cosmic Winter*. They linked impacts to the "Taurid Complex," a supposed cluster in Earth-crossing orbits of remains from disintegration of a ~100-km diameter outer solar system "Centaur" that entered the inner solar system. How such an enormous body broke up is difficult to conceive. Napier, now a CRG member, provides the little (and non-mainstream) astronomy that underlies the YDIH (see Wolbach et al. 2018).

Centaurs have elliptical orbits that cross the orbits of the giant outer planets, so possibly a large Centaur could be gravitationally deflected into the inner solar system. Could a fragment of such a huge object have struck Earth 12,900 years ago? A key question is: What happened to the rest of its debris? Even a 4-km piece of a 100-km object (whether a single body or swarm of bodies with equivalent mass) is less than 0.01 percent of the total; where is the other 99.99 percent? The Earth and other terrestrial planets are not very efficient at sweeping up such debris in the emptiness of interplanetary space; the timescale for clearing of Earth-crossing bodies by terrestrial planet impact or by gravitational scattering is 10 to 100 million years, so most debris should still be orbiting the Sun (in mainly Earth-crossing orbits). Various sensitive surveys from ground- and space-based telescopes have now discovered >95 percent of all Earth-crossing asteroids and comets >1 km diameter, about thirty times the number known three decades ago when Napier was promoting a Taurid stream. There are no

significant streams of bodies down to 100 m diameter, for which we have discovered one-third of the population compared with <1 percent originally known by Napier. Any such stream, if real, would have been discovered by ongoing surveys.

The impact rates of various sizes can be estimated by counting impact craters on the Earth and Moon, estimating size and frequency of superbolides entering the Earth's atmosphere, and comparing with the numbers of survey-discovered Earth-crossing asteroids and comets. The average impact flux has varied little over billions of years, although short-term "outbursts" that don't dominate the average flux have happened. Recent estimates of small asteroid impact frequencies by Alan Harris and Paul Chodas (2021) and by David Nesvorny and colleagues (2024) agree fairly well in the >1 km diameter size of interest for the YDIH and can hardly be significantly wrong because we have already discovered more than 90 percent of the population. (Those estimates do seem to underestimate impact rates by not more than an order of magnitude at less relevant small sizes, <100 m, compared with superbolide observations and the comparatively recent 1908 Tunguska impact in Siberia.)

The estimated impact frequency of an asteroid 4 km or larger is about once in ten million years, so a suggestion that such an event occurred only about 10,000 years ago is unlikely by about a factor of nearly 1,000. Comet impacts are much less frequent, less than 10 percent of the flux of asteroids, leading to an even greater factor (at least 10,000 to one) of improbability. While improbable events do happen, "extraordinary claims require extraordinary evidence," which is badly lacking for the YDIH. Furthermore, if as claimed only a small fraction of the mass struck the Earth, the time scale for the Earth to sweep up the rest of the mass is a million years or longer, depending on the orbit of the "stream," so appreciable residue should still be out there, but such bodies do not exist.

The YDIH Is a Failed Hypothesis

There are many reasons for rejecting the YDIH. Proponents assume that the YD was unique, thus invoking a rare cosmic impact. They neglect other coolings during the most recent glacial retreat; YD was merely the most recent. They misinterpret dating of their supposed impact markers as indicating a single global catastrophe while many ages are discordant. They neglect differences between comets and asteroids and introduce the physically implausible idea of a collision by multiple fragments from a large disintegrating comet. Thus, the hypothesis is largely decoupled from multiple mainstream science disciplines (e.g., paleoclimatology, geology, impact physics, astronomy) and is accordingly rejected by most experts.

The human brain is ill-equipped to understand and relate to probabilities, especially very tiny chances. That is why national lotteries can raise so much money and how the Comet Research Group can solicit funds on their website warning ominously that "Your city may be next!" But impacts by large asteroids or comets are exceedingly rare and cannot be robustly invoked to explain geologically or historically recent events.

As CRG promotion of the YDIH has evolved during recent years, there have been disturbing aspects that we consider make it "pathological science," including irregular methods of research and publication with religious subcurrents. We intend to address this aspect of YDIH in the future. ■

Acknowledgement

We thank CSI Fellow Mark Boslough for his considerable assistance with this article.

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David Morrison is retired from NASA Ames Research Center and the SETI Institute. His research has concerned planetary astronomy and astrobiology. He has long been a critic of pseudoscience in astronomy.

Alan W. Harris is a retired senior research scientist at Jet Propulsion Laboratory, where he studied asteroid spins and dynamics and the threat from asteroid impacts. He still continues assessing the progress of surveys in discovering and cataloging potentially hazardous asteroids (PHAs).

FUN & GAMES

Edited by Stephen Hupp

YOU CAN FIND THE ANSWERS TO THESE GAMES IN SECRETS REVEALED (P. 66).

1	2	3	4
2			
3			
4			

SKEPTICROSS

ACROSS

1. Artoo-Detoo
2. MX
3. 1 (as represented in 4-bit binary code)
4. MC

DOWN

1. Airship referred to as "Britain's Hindenburg"
2. *A Space Odyssey* (original's year)
3. Die with one hundred sides
4. *The Year We Make Contact* (sequel's year)

Dr. Spock

Mr. Spock

SCIENCE OR FICTION?

On *The Skeptics' Guide to the Universe* podcast, host Steve Novella presents "three science news items or facts, two real and one fake." The following items were from the 1,000th episode, so the theme was the number 1,000. Can you tell which item is the fake?

#1: There are roughly 1,000 stars within forty-five light years of Earth.

#2: A recent census of a 430 square meter urban property in Brisbane, Australia, found over 1,000 macroscopic species (basically in one yard with a house).

#3: In 2021, the median household income in the world was just over $1,000 per year.

WHO'S THAT NOISY?

On *The Skeptics' Guide to the Universe* podcast, Jay Novella plays a provocative sound, and listeners guess the sound's source. Below are some statements from Dr. Spock (the twentieth century pediatrician and author) and Mr. Spock (the twenty-third century science officer from *Star Trek*). Can you guess who said what?

Trust yourself. You know more than you think you do.

Insufficient facts always invite danger.

Without followers, evil cannot spread.

Logic is the beginning of wisdom, not the end of it.

In critical moments, men sometimes see exactly what they wish to see.

Man can be the most affectionate and altruistic of creatures ...

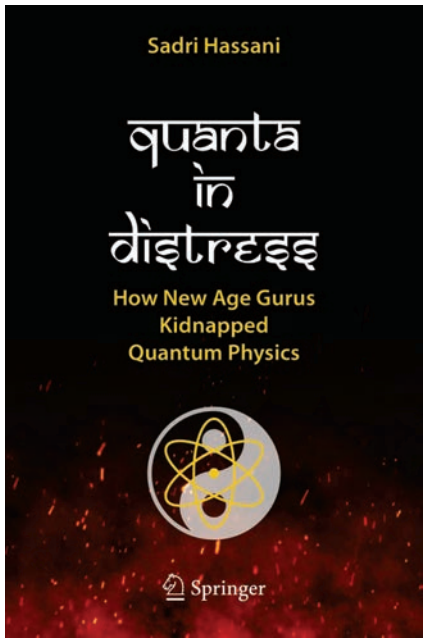
Calling Out Quantum Woo

Taner Edis

In pop culture, *quantum* has come to mean magic. Because I teach physics, I sometimes get questions about quantum stuff, upon which I'm expected to expound on the spiritual implications of quantum physics. I try to point out that quantum physics is just, well, physics—that it isn't entangled with woo. If my audience is predisposed to think I know what I'm talking about, or if they're taking an exam where they have to figure out the physics mistakes in a quotation from a "quantum healing" guru, I can get away with denying that quantum physics has anything paranormal about it.

I am not the only physicist irritated by quantum mysticism. And when academics want to reach a larger audience, they write a book. Sadri Hassani, a fellow physicist annoyed with popular abuse of quantum physics and a fellow skeptic familiar to readers of Skeptical Inquirer, has written *Quanta in Distress* to persuade his readers that quantum woo is pernicious nonsense.

There is a small literature debunking quantum mysticism; the works of Victor Stenger come to mind. *Quanta in Distress* is a welcome addition to such skeptical resources. Hassani writes for readers who are not physicists, explaining why quantum mechanics does not, in fact, support any notions of consciousness determining reality. He does not scare anyone away with math—unless they want to consult a few short appendices. And more than some other skeptical literature, Hassani acknowledges that physicists bear some blame for quantum mysticism. Indeed, many big name physicists involved with the formulation and later development of quantum physics indulged in mystical speculation. Quantum phenomena are very counterintuitive, and some physicists drew on philosophical and theosophical notions current in the intellectual milieu of the early twentieth century to try to make sense of the quantum world. None



Quanta in Distress: How New Age Gurus Kidnapped Quantum Physics. By Sadri Hassani. Springer, 2024.

of this really worked, and physicists today have generally accepted that quantum physics will never seem correct according to normal human intuitions suited to everyday, non-quantum phenomena.

Quanta in Distress is a short book; Hassani provides a selective rather than comprehensive technical critique of quantum mysticism. I found that I largely agree with his choices. For example, Hassani points out that the probabilistic nature of quantum mechanics is at the root of much conceptual confusion; I think this is correct. As a result, however, he puts less emphasis on entanglement and nonlocality as a source of quantum abuse. There is nothing wrong with such a choice, and Hassani makes it clear that entanglement does not support fantasies such as faster-than-light communication or holistic connections between everything. Nonetheless, a reader looking for more details on exactly why nonclassical correlations don't support mysticism will have to chase down the more technical references Hassani provides.

I also suspect that this is not the right book to recommend to someone who has already been sucked into mystical and paranormal beliefs padded with quantum rhetoric. Hassani, appropriately, is completely unsympathetic to quantum woo, but a reader not steeped in the culture of science may well find his uncompromising approach off-putting. I also wonder if all his explanations of genuine physics will work. I am no judge, as I automatically found myself translating the physics back into equations. In practice, a non-physicist has to trust the authority of Hassani and the community of physicists. Many paranormal believers have a self-image of fearlessly questioning the authority of ossified orthodoxies, and this book will rub them the wrong way.

As with any good book, *Quanta in Distress* also left me with unanswered questions. One that sticks out for me is why, even today—long after the floundering philosophizing of physicists inventing quantum mechanics 100 years ago—a small minority of physicists still promote quantum mysticism. I occasionally run into books by perfectly legitimate physicists that argue quantum physics supports Eastern theosophy. Some years ago, while looking for a textbook to use in my quantum mechanics course, I considered a text that was boringly respectable in every respect, except that it was authored by a professor who also wrote popular books claiming quantum physics supported Eastern mysticism and paranormal woo. ■

Taner Edis (edis@truman.edu) is a CSI fellow and professor of physics at Truman State University. His latest book is *Weirdness! What Fake Science and the Paranormal Tell Us about the Nature of Science* (Pitchstone, 2021).

Lincoln and Spiritualism

Jason Emerson's article "Harry Houdini Debunked Claims of Abraham Lincoln's Spiritualism" (SI, March/April 2025) gave great insight into Abraham Lincoln's life. Though not a Spiritualist himself, he supported his wife's beliefs and stayed by her side as she attended events involving Spiritualism. His compassion showed his willingness to embrace different perspectives and a different side of his presidency. Other political leaders believed his participation in séances was damaging to his reputation and distracting from his duties as president. However, Lincoln put family first, embodying the ideal relationship values of America. Having a president whose commitment to providing understanding for his wife while they go through grief—in the face of criticism—humanized him, showing that he was more than a man of reason and logic but also empathetic, open-minded, and comforting. Their story is a much-needed reminder of the intricate balance of work, family, beliefs, and struggles of one of the most pivotal periods of our history in America.

Niki Chambers
Smithton, Illinois

I found Jason Emerson's article on how Harry Houdini assisted in successfully debunking the claim advanced by Spiritualists that Abraham Lincoln was a believer in Spiritualism along with his wife Mary (who clearly was) to be very interesting. However, a correction is in order: While Gideon Welles may well have been a believer in Spiritualism, he was emphatically not the Secretary of War as stated in the article. He was Lincoln's Secretary of the Navy. Edwin Stanton was Lincoln's Secretary of War.

Dennis Middlebrooks
Brooklyn, New York

Devil on Trial

As per usual, I've very much enjoyed my latest issue of the Skeptical Inquirer. Joe Nickell's article "Possession? Exorcism? Murder? *The Devil on Trial*" correctly pointed out the doubtful veracity behind Netflix's latest "documentary" on the Warrens. At the risk of sounding petty, I'd like to add another nail in the coffin of the program's credibility: How can this documentary on the Warrens, two Catholics, really be trusted, when the poster art can't even illustrate rosaries correctly? For non-Catholics, a rosary is a loop consisting of five sets of ten smaller beads separated by single large ones, topped by an extension of five more beads before ending in a small crucifix. The ex-(devout)-Catholic that I am can't help but chuckle at the totally random number of beads in the poster. Maybe the Devil did it …

Joseph Gagné, PhD
Historian
Québec, Québec, Canada

Astrology and Discrimination

I have always had a mild discomfort that arises when a friend or acquaintance brings up the subject of astrology in my presence. I have learned to shrug it off with humor, saying things such as "I was born under a No Smoking sign." How could the position of planets, stars, and the Moon or Sun have any bearing on my or anyone else's behavior and personality? After reading Craig Foster's article on astrology as depicted in the show *Cosmic Love* (SI, March/April 2025), I realized the reason for my irritation. It is a way to stereotype and discriminate against people. I have always believed we should treat others with respect rather than prejudice, and the article really helped me realize where that discomfort was coming from. Thank you, Craig Foster, for your work, and I am happy you are a fellow Northwesterner!

Bill Engle
Friday Harbor, Washington

Gene Therapy/Genetic Engineering

Andrea Love's article, "mRNA Vaccines Aren't Gene Therapy, but Gene Therapy Is Nothing to Fear," is an excellent article but omits the genetic therapy for Sickle Cell Anemia and Type I Diabetes.

Bertha Vazquez's article, "Real World Harms from Pseudoscience and Science Denial," contains erroneous information. To her credit, she might not be the source of the information (because she was reporting on a talk given at CSICon 2024). Kevin Folta, a professor of horticultural sciences at the University of Florida, allegedly identified "hornless cattle" as an example of genetic engineering. Polled cattle have been noticed for centuries. There are breeds of "hornless" beef and dairy cattle. This is *not* genetic engineering but selective breeding. Cattle breeders were practicing breeding techniques before Gregor Mendel's research.

John Roach
Jonesboro, Arkansas

Kevin Folta responds:

My CSICon presentation described the creation of polled dairy cattle using genetic engineering. The mutation conferring the hornless trait in black angus was reproduced in typically horned dairy cattle using a gene editing approach, leading to hornless dairy cattle. (See "Production of Hornless Dairy Cattle from Genome-Edited Cell Lines" in Nature Biotechnology, 2016).

Do Minds Have Immune Systems? Online Debate

Editor's note: In addition to writing his "Behavior & Belief" column for the print magazine, Stuart Vyse publishes some articles as digital exclusives. On March 7, 2025, Vyse wrote an article titled "Why I'm Not Sold on Mental Immunity," critiquing a previously published article written by Andy Norman, Luke Johnson, and Sander van der Linden ("Do Minds Have Immune Systems?" in the *Journal of Theoretical and Philosophical Psychology*, 2024). Norman, Johnson, and van der Linden have since responded to Vyse's critique ("On the Rejection of Mental Immunity: A Reply to Vyse"), and their response—as well as an additional comment from Vyse—can be found immediately following Vyse's critique at skepticalinquirer.org. Lastly, this is a good time to point out that all SI's digital articles are freely available to subscribers of the print magazine (and many are freely available to everyone).

Send in a Letter to the Editor

Letters to the Editor are for views on matters raised in previous issues. Letters should be no more than 225 words. Due to the volume of letters received, not all can be published. Those selected may be edited for space and clarity. Authors criticized in the Letters column may be given the opportunity to respond in the same issue. Submit Letters to the Editor by email text (not attachment) to letters@skepticalinquirer.org. In the subject line, provide your surname and informative identification, e.g., "Smith letter on Jones evolution article." Include your name and location (city, state) at the end of the letter.

PODCAST PICKS

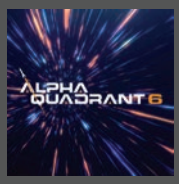
Edited by Stephen Hupp.

THE SKEPTICS' GUIDE TO THE UNIVERSE. Hosted by Steven Novella, the longest-running skeptical podcast includes discussions about "the latest science news, critical thinking, bad science, conspiracies and controversies." Cohosts include Robert (Bob) Novella, Cara Santa Maria, Jay Novella, and Evan Bernstein. 1,000+ episodes spanning twenty years.

TALK NERDY WITH CARA SANTA MARIA. Cara Santa Maria is a "science communicator, television host, producer, and journalist" with an affinity for engaging in thought-provoking "conversations with interesting people about interesting topics." 500+ episodes spanning eleven years.

WHICH GAME FIRST. This podcast "explores the vast world of board games, digging up hidden treasures and burying the junk." Episodes are hosted by a "panel of gaming professionals," including Evan Bernstein, Celeste DeAngelis, Mike Grenier, Ed Povilatis, and Aimee Toms. 200+ episodes spanning eight years.

GEOLOGIC PODCAST. Having "no geology content whatsoever," the title mashes the first name of the host—George Hrab—with the word *logic*. Episodes include "personal stories, comedy sketches, news commentary, music and movie reviews, science advocacy, original songs, and interviews." 900+ episodes spanning eighteen years.



ALPHA QUADRANT 6. Jay, Bob, and Steve Novella review movies and shows, discussing the "science in Science Fiction." They also point out "where all these shows got the science wrong." Thirty-two episodes were released in 2022 and 2023. New episodes are coming in 2025!

SECRETS REVEALED

Skepticross Answer

1 R	2 2	3 D	4 2
2 1	0	1	0
3 0	0	0	1
4 1	1	0	0

Science or Fiction Answers

#1: SCIENCE

#2: SCIENCE

#3: FICTION
(the median household was closer to $10,000/year)

Who's That Noisy Answer

The first and last statements are from Dr. Spock, and all the others are from Mr. Spock.

Here's more of the last statement from Dr. Spock: "Man can be the most affectionate and altruistic of creatures, yet he's potentially more vicious than any other. He is the only one who can be persuaded to hate millions of his own kind whom he has never seen and to kill as many as he can lay his hands on in the name of his tribe …" (from *Decent & Indecent: Our Personal & Political Behavior*, 1970)

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